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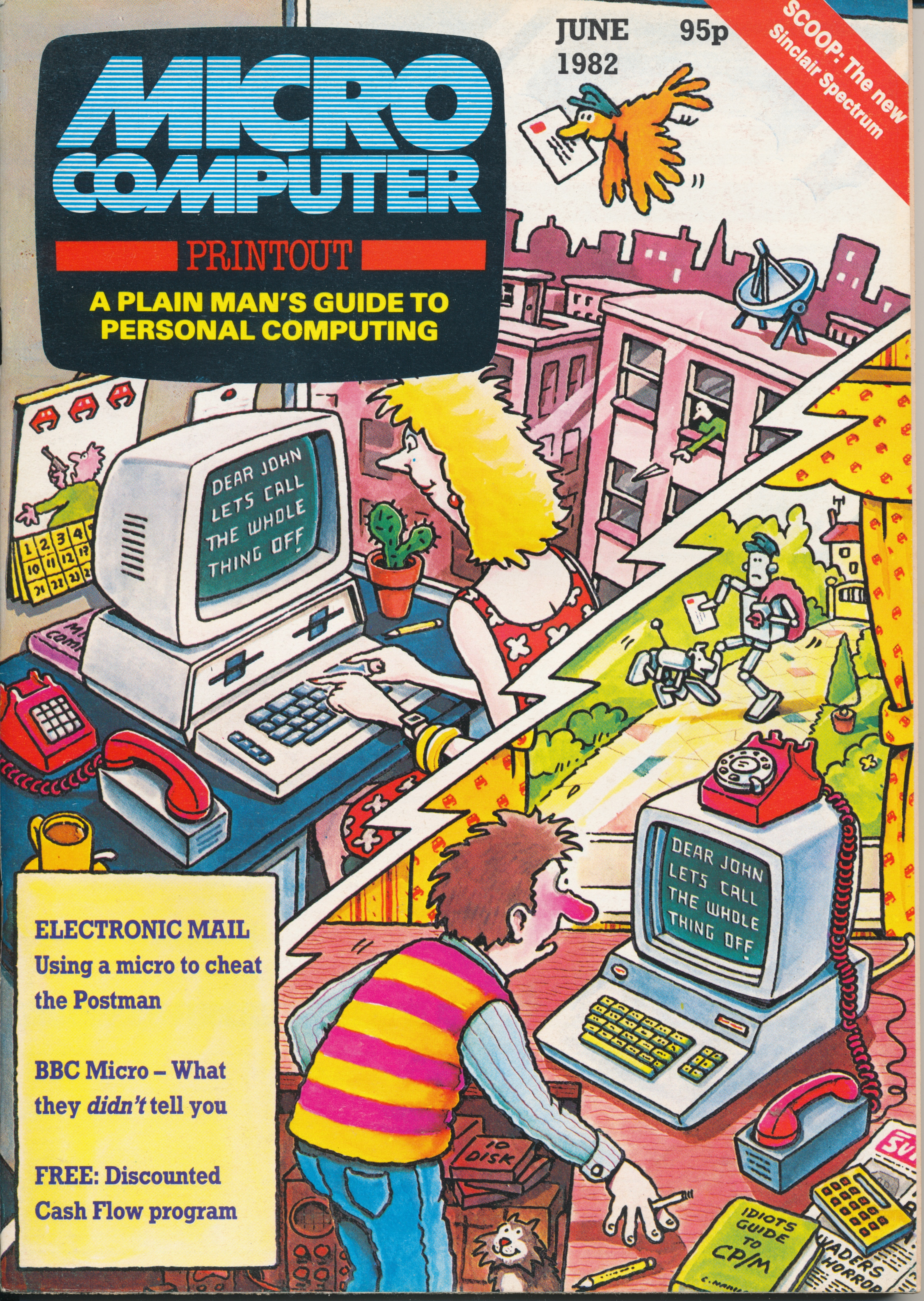
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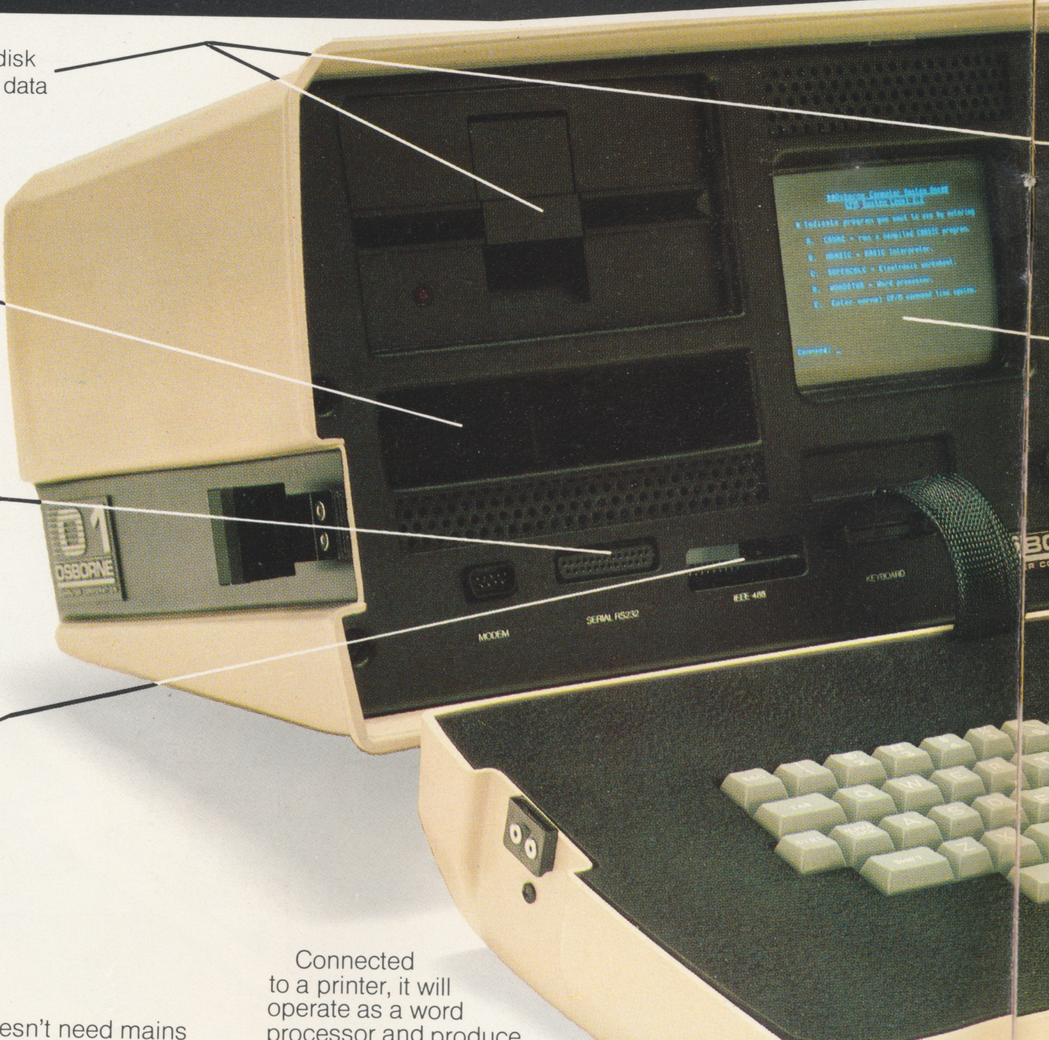

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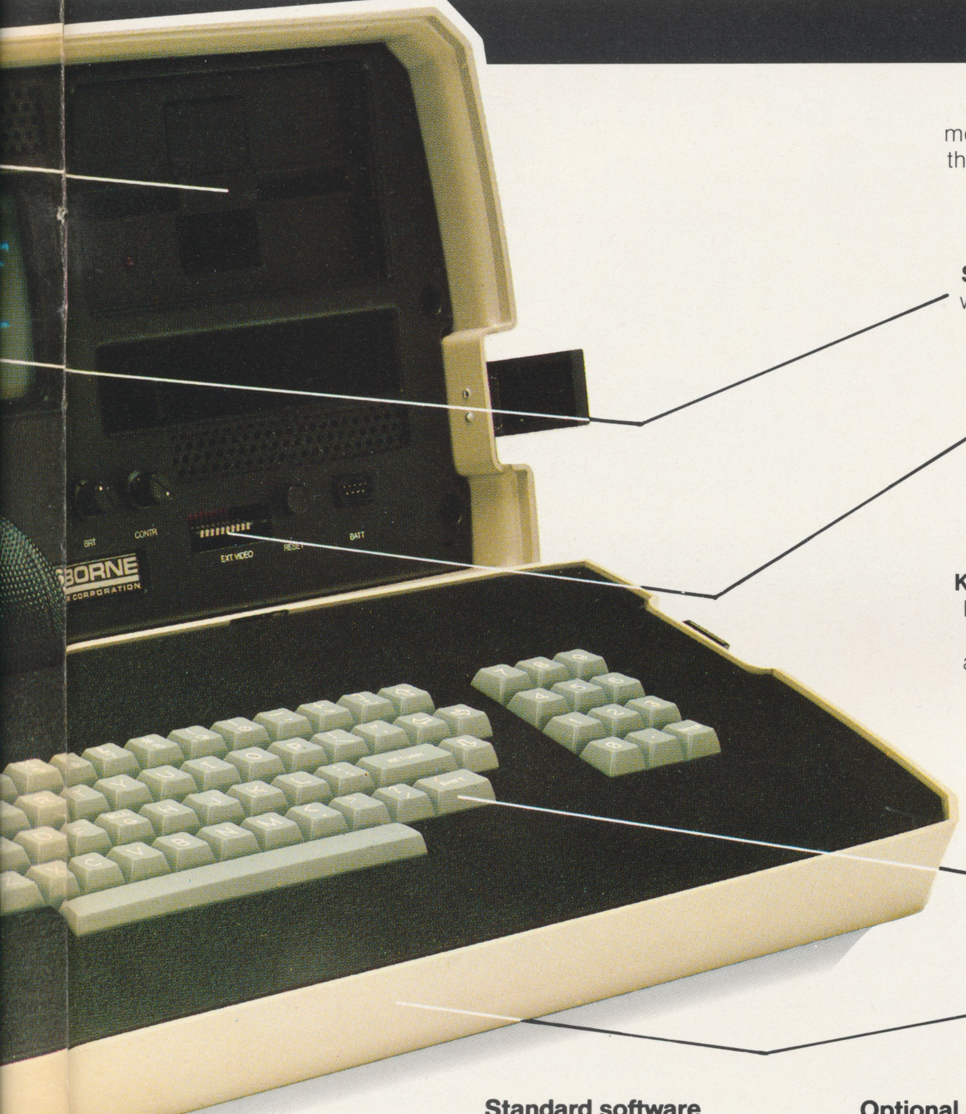

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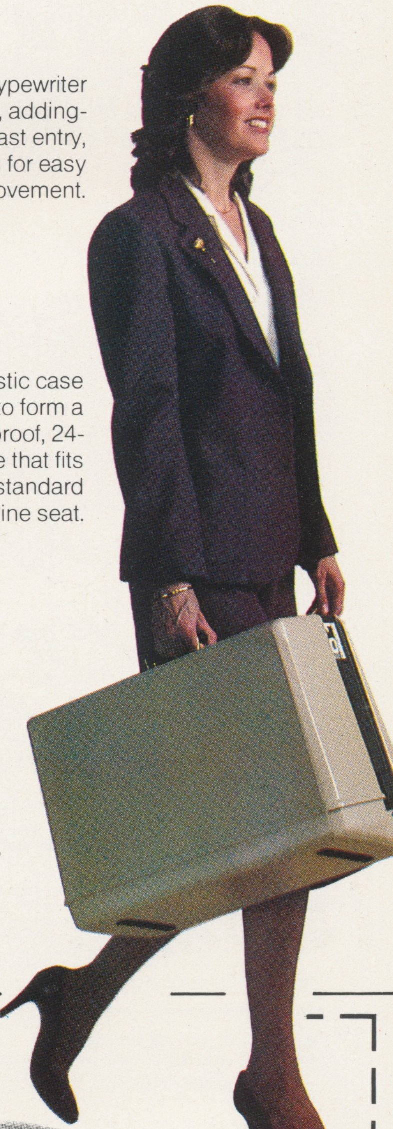

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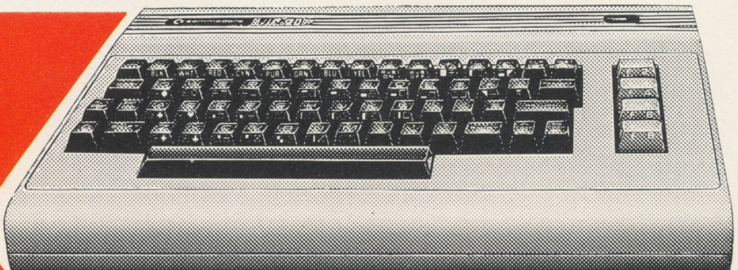

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A PLAIN MAN'S GUIDE TO
PERSONAL COMPUTING

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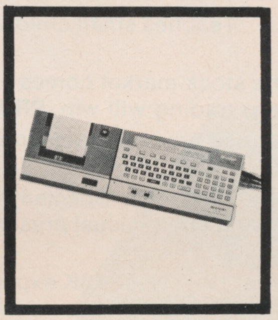

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Technical Editor Chris Preston
Special Correspondents Terry Hope
Dennis Jarrett Mike Gross-Niklaus
Lindsay Doyle David Eldridge
John Gowans Bob Chappell
Production Manager Wendy Cheetham
Overseas Marketing: Al Haig
Editorial Address: P.O. Box 2
Goring, Reading, England RG8 9LN
Telephone: 049162 798
Telex 444423 Attention Printout

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Advertising Manager Jonathan Horne
Advertisement Executive: Karen Chambers
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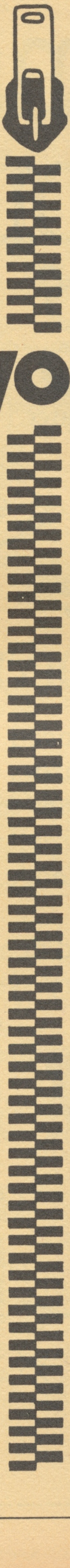

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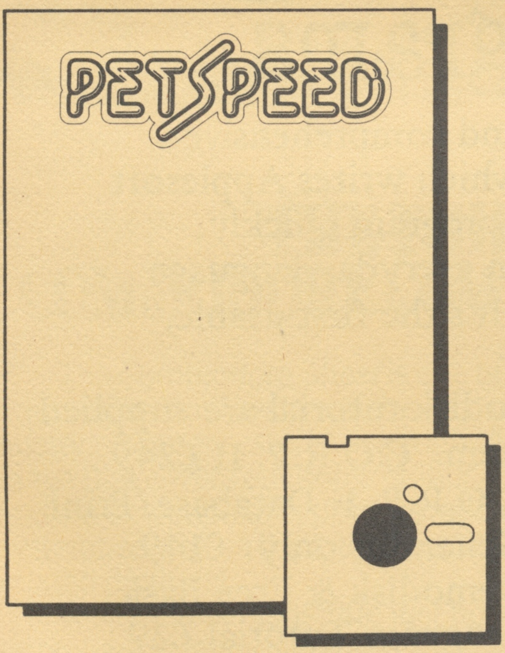

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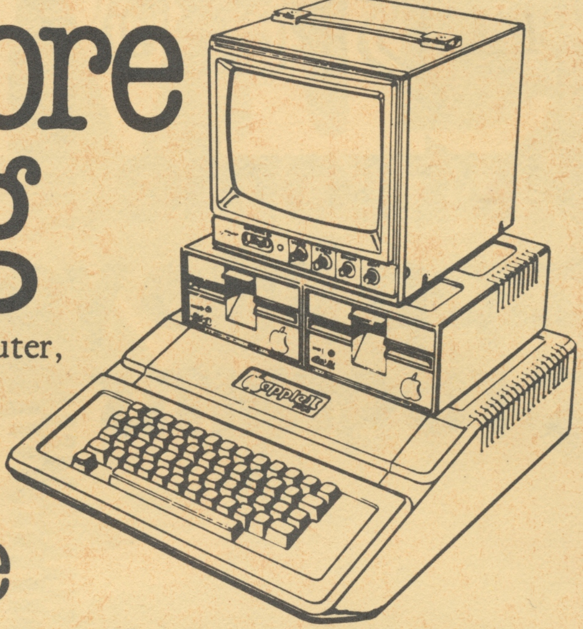

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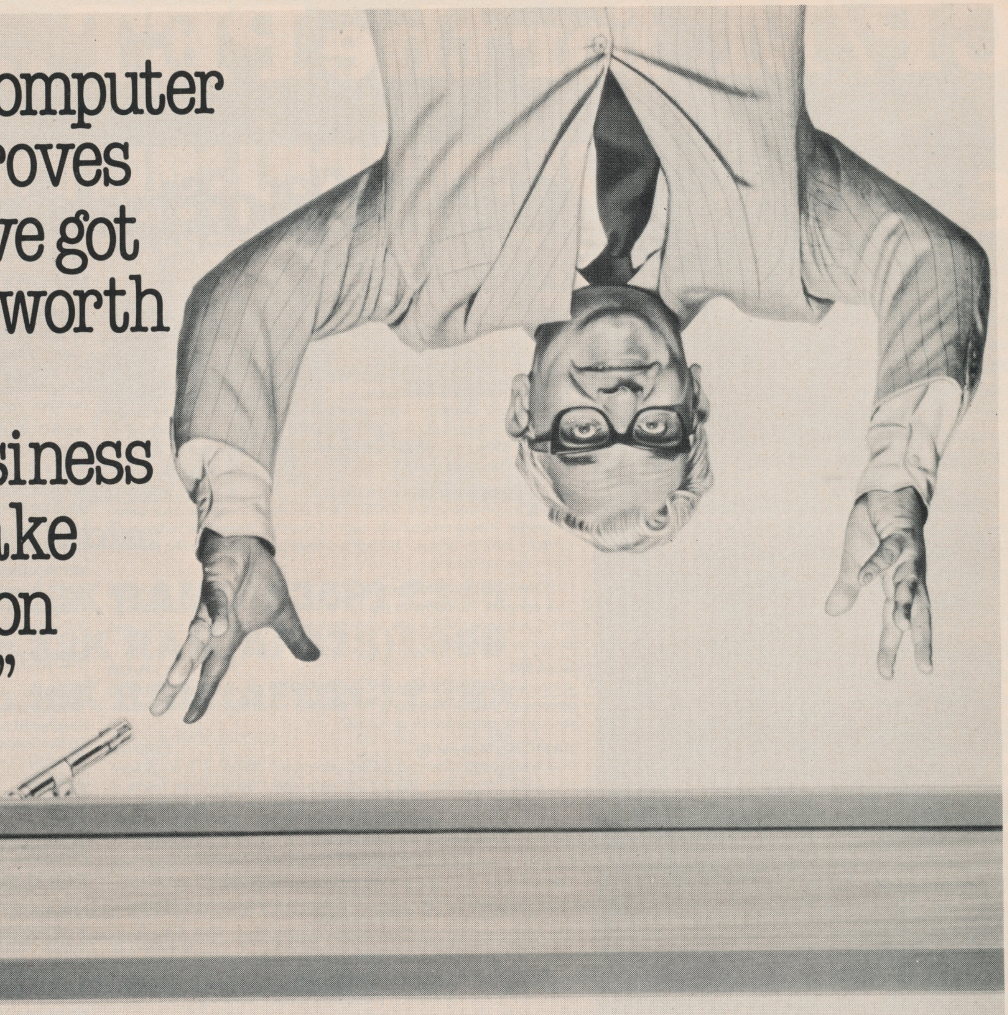

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- Z80 CPU running at 4MHz with no wait states
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CBASIC Compiler Systems £75/£12
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C COMPILER (Whitesmith's) £455/£25
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S-BASIC £195/£20
A structured BASIC compiler generating 8080 native code, combining structured programming and the speed of machine code while maintaining the convenience of BASIC.

BASIC-80 (Microsoft) £175/NA
This is Microsoft Extended BASIC interpreter, version 5. It is a powerful, ANSI compatible disk BASIC with many features not found in PET BASIC, such as WHILE/WEND, chaining, variable length file records, double precision floating point, PRINT USING facility, error trapping, hexadecimal numbers and more.

BASIC COMPILER (Microsoft) £205/NA
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COBOL-80 (Microsoft) £375/£20
An ANSI '74 COBOL compiler producing relocatable modules compatible with FORTRAN-80 or MACRO-80 output. COBOL-80 has a complete ISAM facility and interactive screen handling.

CIS-COBOL (Microfocus) £425/£30
An ANSI '74 standard COBOL compiler fully validated by U.S. Navy tests to ANSI level 1. The compiler also supports many features of level 2 including dynamic loading of COBOL modules and a full indexed Sequential (ISAM) file.

FORTRAN-80 (Microsoft) £230/£20
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PASCAL/MT+ £375/£20
A Pascal compiler meeting the ISO standard, with many enhancements including full string handling capability and random access files.

PASCAL/M £220/£15
This compiler produces p-code and is an extended implementation of standard Pascal, with long (32-bit) integers, a SEGMENT procedure type (for overlays) and an added string data type.

PASCAL/MT £160/£20
This is a subset of standard Pascal, which generates ROMable 8080 machine code and supports interrupt procedures, CP/M file input/output, and assembly language subroutines.

PASCAL/Z (Ithaca Intersystems) £225/£20
A compiler producing ROMable, re-entrants Z80 micro-code highly optimised for speed, supporting variant records strings CP/M file input/output, and assembly language subroutines.

PRO PASCAL £190/NA
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MAILMERGE (MicroPro) £80/£15
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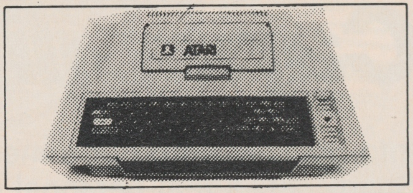

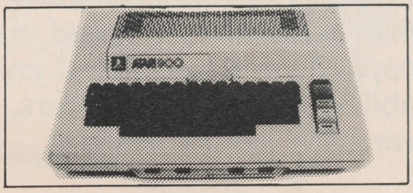

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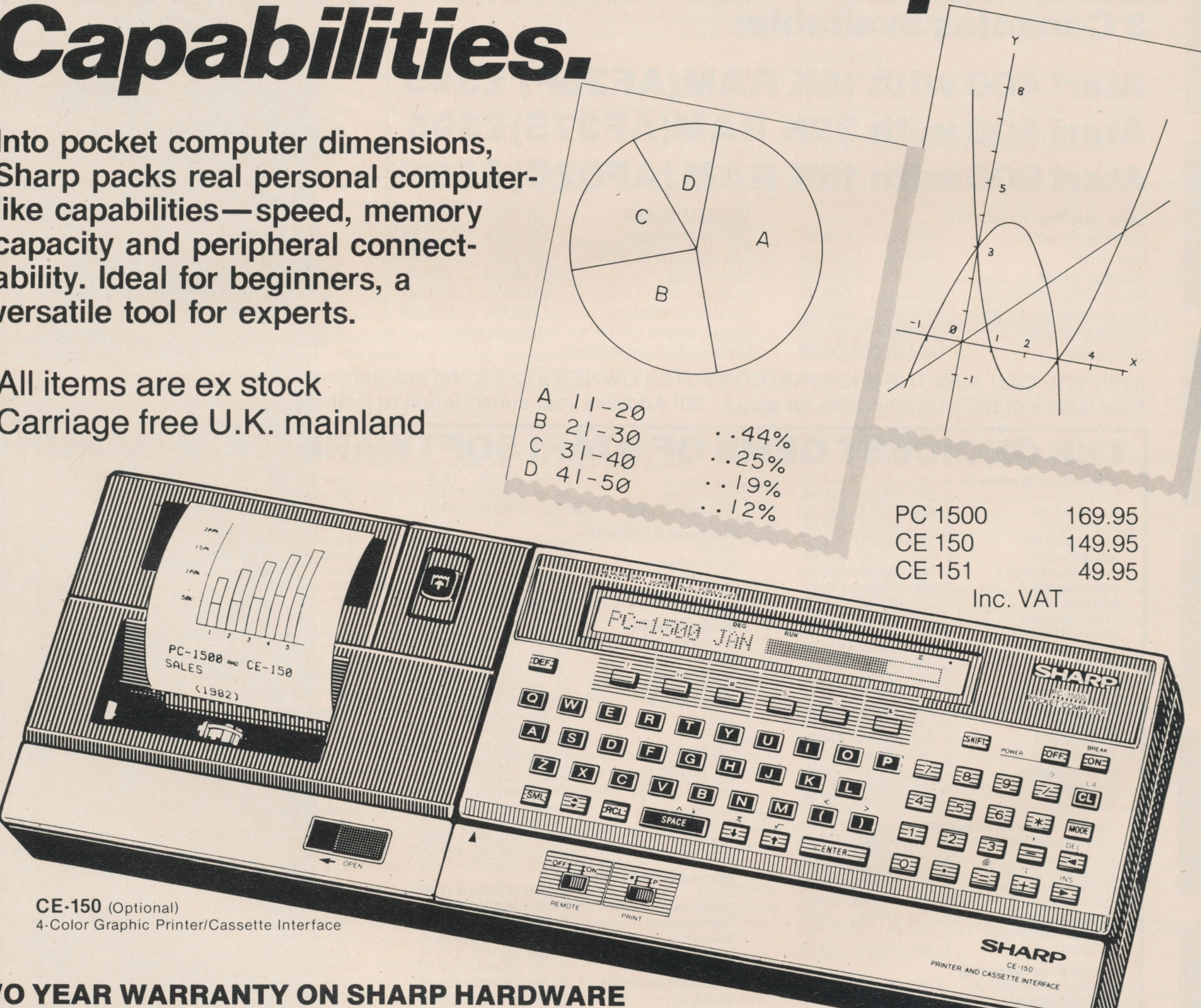

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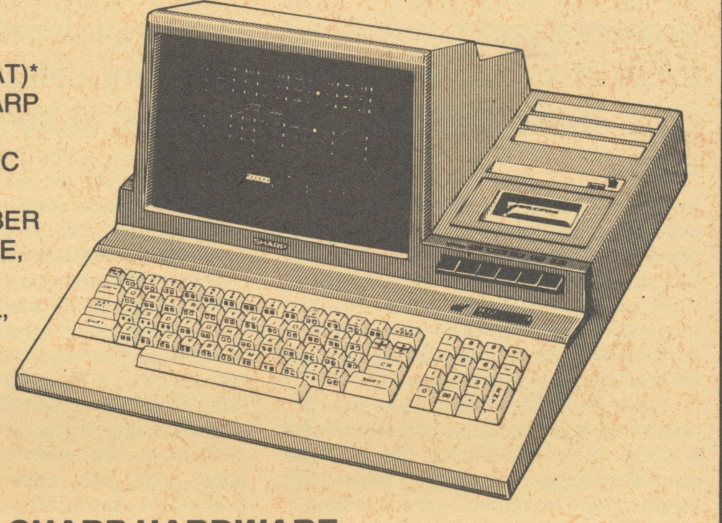

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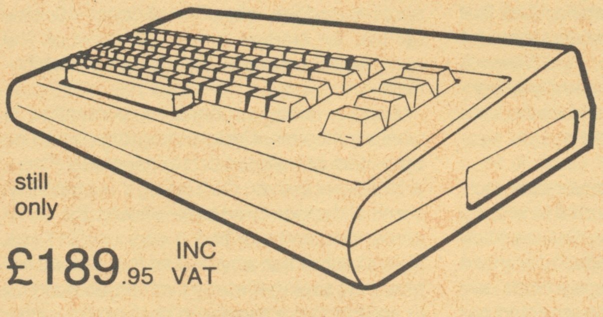

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HOW TO BUY A NOMI

The purpose of a Nominal Ledger is to prepare the final accounts and provide management information. Yet many such micro packages are very deficient in this area. **Spencer Hall** tells you how to spot the duff ones.

Nominal Ledgers are at the top of the accounting tree when it comes to a ledger pecking order. The function of a Nominal Ledger (or General Ledger as they are sometimes called) is to collect information from subservient ledgers such as sales or purchase ledgers, and collate it to produce the final accounts. (See Diagram 1).

In order to facilitate the production of accounts, accountants usually break the main functions of an organisation into separate compartments such as payroll or sales/credit control. These departments produce weekly or monthly summaries which are then passed up the information tree to the nominal ledger where the figures are posted to produce the final accounts.

The work is processed in this way as it enhances control of information and expedites production of the final accounts for end users of financial data such as management and investors.

So any nominal ledger program must basically perform the functions outlined above. Which is rather sad as not many of the packages currently available do.

Management decisions

Industry and commerce need up-to-date information on the financial state of the company in order to be able to make the correct decisions regarding the management of its scarce resources. That information is only valuable if it is accurate and available when required. Many small traders receive their accounts from their accountant anything up to 12 months after their year end. By this time the information is totally useless except for agreeing tax liabilities with the Inland Revenue. The accountant could well end up sending the accounts to the receiver or worse still, the liquidator!

So what sort of characteristics should you look for in a good nominal ledger package?

One of the first things you will have to do is to enter your account code structure. You may be given a standard index – fine if you don't mind having your account code structure dictated to you by someone who's never seen your business. Not so fine if you already have your own code structure which everyone is used to. To create a unique code of accounts for your business should not take longer than one hour. Any longer and you can throw the program out the window.

Next see how many entries you can make in one posting. Analysing a complicated cash book could entail posting to 50 or 60 different ledger accounts. As the total of debits and credits won't balance until you have included all the entries it is pretty useful to be able to post the complete batch intact. Make sure that the program will accommodate at least 50 entries in one batch without complaining.

Also test the program to make sure that only balanced batches can be accepted for posting. Some programs query a difference but then let you post to the ledger if you confirm that it's OK. Have you tried looking for a difference on a computerised ledger system? Not recommended.

Can the program accept reversible journals? At the end of each month there are a number of entries which are estimates such as the amount of loan interest due at any one time. These accruals or prepayments are closing adjustments which are reversed out again at the beginning of the next month. It is a relatively simple matter for the computer to keep a log of such entries and reverse them out for you automatically at the beginning of the next month. This facility is a basic requisite of any nominal ledger program.

Waste of time

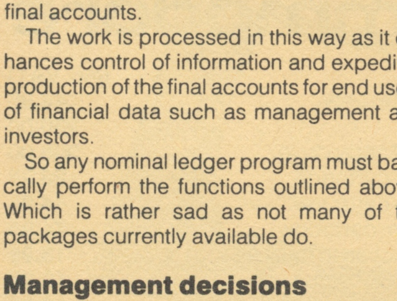
If you are doing monthly accounts then you need to know the value of income and expenses for the month and what the year to date is. Anything less is a complete waste of time.

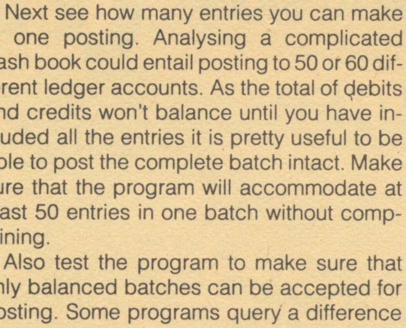
You may be offered the ability to include budget figures on your accounts alongside the actuals. This can be quite useful but the program is unlikely to have the flexibility of a good financial modelling program such as VisiCalc or MicroModeller. Also consider that you may wish to keep the budget figures separate from the actual results as you don't want the regional sales manager to see how much below budget his expenses are.

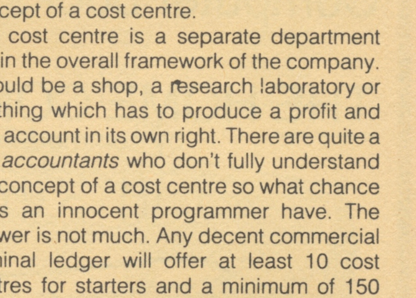
Where most nominal ledger programs come down with a howling crash is on the concept of a cost centre.

A cost centre is a separate department within the overall framework of the company. It could be a shop, a research laboratory or anything which has to produce a profit and loss account in its own right. There are quite a few *accountants* who don't fully understand the concept of a cost centre so what chance does an innocent programmer have. The answer is not much. Any decent commercial nominal ledger will offer at least 10 cost centres for starters and a minimum of 150 nominal ledger codes if it's to be of much benefit.

Another frequent bone of contention is whether a nominal ledger program should be open item or balance brought forward. There is little point in even discussing this area as all nominal ledger programs should be open items. Accountants find it very useful to be able to scrutinise an account for unusual entries – by seeing the way that entries build up in an account it is easy to spot obvious mis-







MINAL LEDGER

takes. If the suspense account is split across a dozen printouts then continuity is lost. Which is one reason why card systems are so popular – you can clearly see what has been going on at a glance.

Proof sheet

Audit trails are another tricky area for limited companies. It is important for a company's auditors to satisfy themselves that only authorised entries have been made to the ledger. By sequentially numbering jounal entries any internal or external auditor can quickly check that all entries made to the ledger have been duly authorised. So ensure that there is some form of day book or proof sheet listing all entries made to the ledger.

Obviously the program must produce a trial balance which you can understand. Not a consolidated version but one detailing the balance on each account by cost centre. It must restrain itself from getting too carried away by printing out all the zero balances on every account ever created otherwise the figures you require become submerged in a sea of green music paper.

The final accounts are the most useful schedule which any nominal ledger program can produce. The final accounts are basically produced from the trial balance so if you have a trial balance then there is no reason why you can't have accounts as well. Unfortunately not all programs give you final accounts as there are relatively few programmers around who understand the difference between a trading account and a profit and loss account.

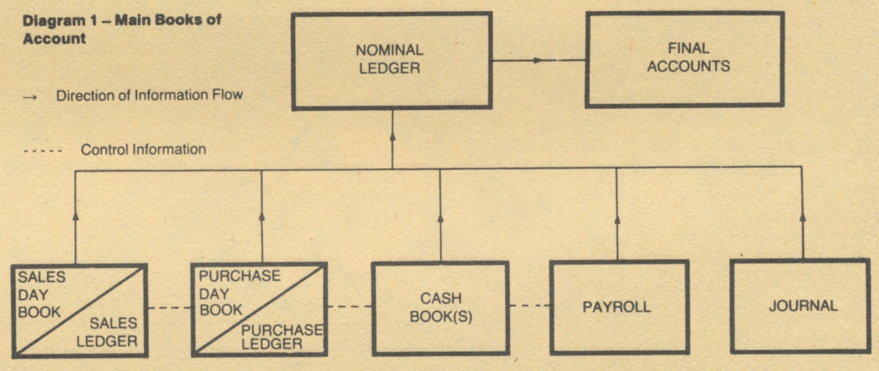
There seems little point in travelling to your destination only to get off at the penultimnate stop. All nominal ledger programs are capable of giving your final accounts – if the computer salesman tells you otherwise vote with your feet.

The accounts should be produced in such a way that you can actually understand them. There is no reason why you can't take the accounts straight from the printer and put them before a Board of Directors for discussion.

Final adjustments

One publically quoted company in the wines and spirits business has an IBM mainframe to process its nominal ledger but the program does not produce final accounts. An army of accountants sit down and make the final adjustments by hand, the accounts are then typed out from pencil drafts, checked, corrected, and only then are they finally presented to the board for discussion. That program alone cost £20,000. My own company 'Accounting Software' has produced a similar program which runs on an ordinary PET, costs less than £1,000 and produces a complete set of accounts which can be presented directly to a Board meeting.

Diagram 1 – Main Books of Account



It is also nice to have a program which complies with the laws of the land. The recent 1981 Companies Act incorporates parts of the EEC's Fourth Directive which prescribe how a Profit and Loss account and Balance Sheet should be laid out. Although not an essential requirement for accounts used for internal purposes, it's comforting to know that your not buying an obsolete program.

At all times it should be possible to break down any figure appearing on the final accounts to its component parts. For example debtors will probably comprise trade debtors, staff advances, and prepayments. So you need a figure for each one. Each figure must agree of course to the trial balance. Further analysis of staff advances must be available by calling up the page from the nominal ledger itself. If you have had various loans out to members of staff, you need to know who owes you the money and who's paid off their accounts. That's why some people still prefer a card system as you can follow the movements in and out of the account because continuity is maintained. Therefore the computer should give you a close equivalent to a card system in appearance and the way in which transactions are presented on the screen or printed out.

Integrated systems

Now a word about integrated systems. A lot of people like the idea of a fully integrated accounting system for their microcomputer. Because most mainframes have integrated accounting systems it doesn't follow that micros should have them too. A mainframe computer will have access to vast amount of disk storage space of at least 50 million characters whereas a typical micro is struggling to get above half a million.

There are two serious problems in having a

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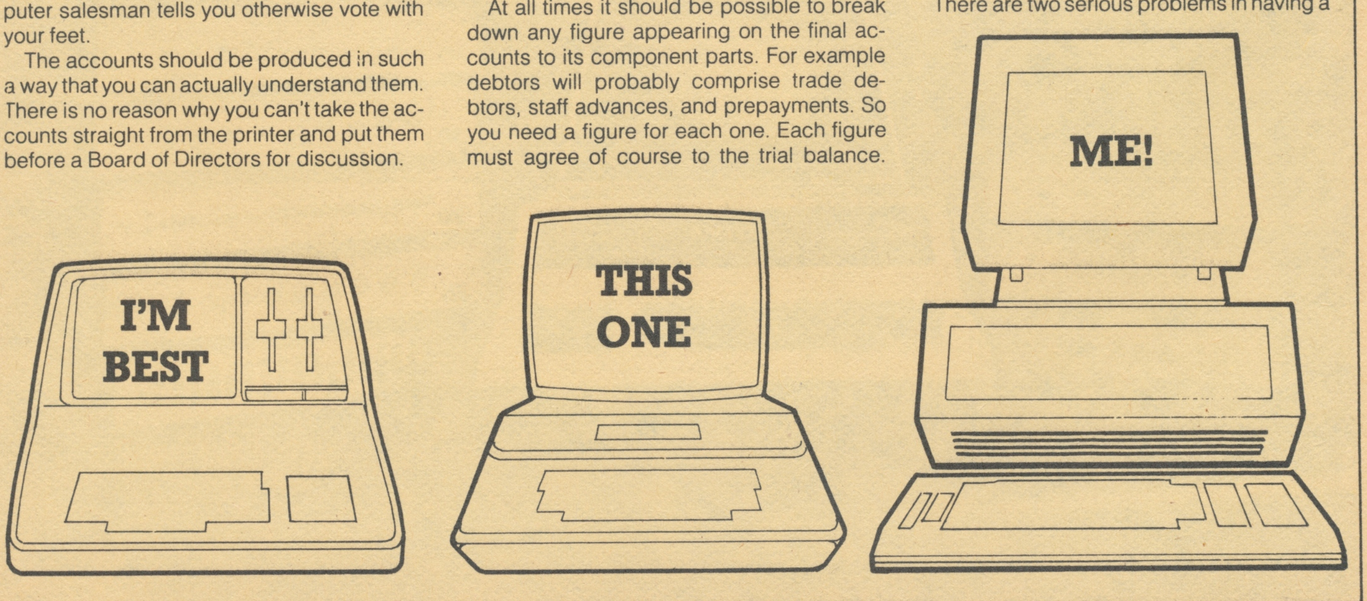

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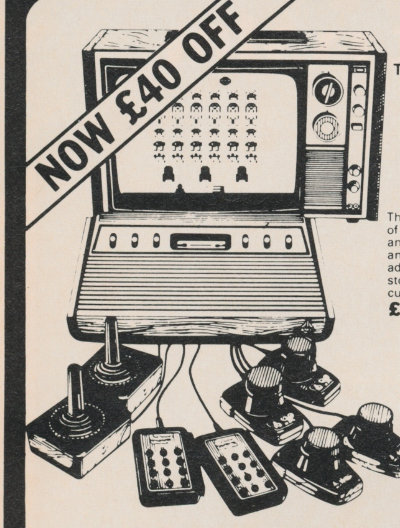

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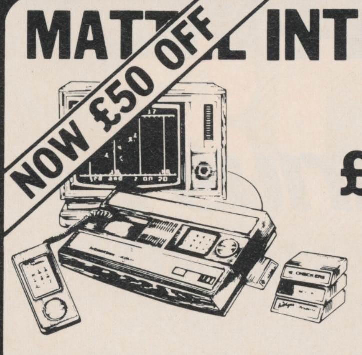

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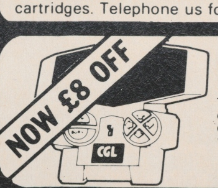

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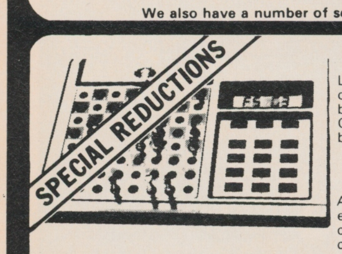

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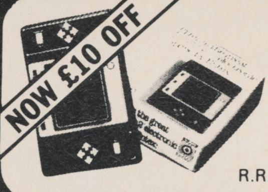

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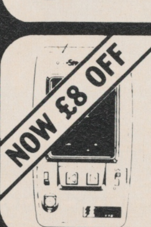

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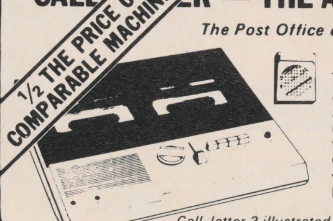
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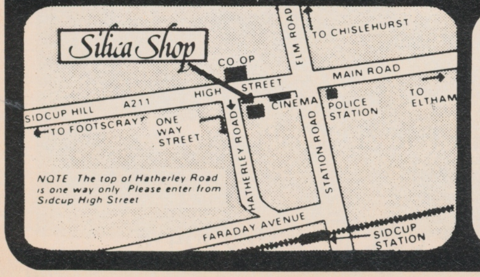

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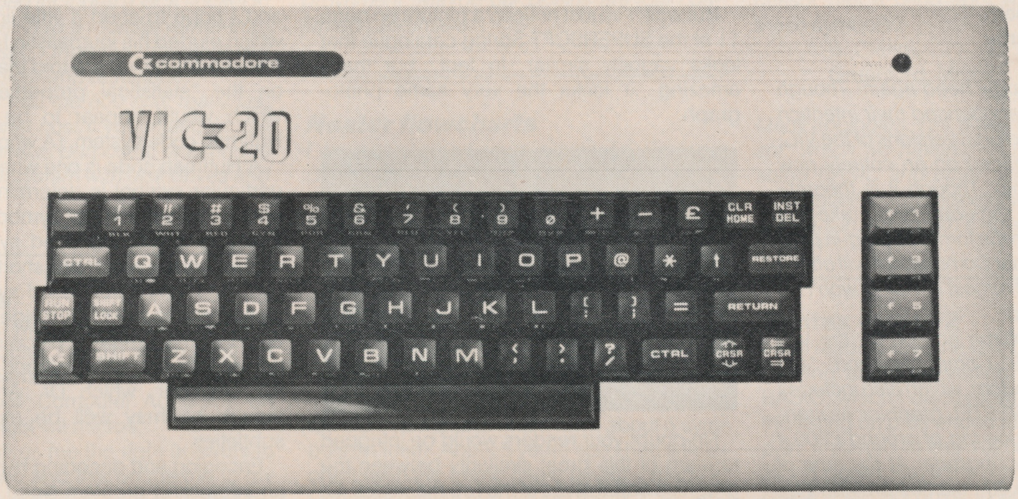

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READ/WRITE

Double vision

With the advent, and imminent launch of such machines as the Commodore 64, the Ultimax and the SuperVic, is it likely that Commodore will introduce a 40-column conversion for the VIC 20? The VIC's 22 columns can be quite restrictive.

Richard Abel,
Repton, Derby

Catch-22 rears its ugly head again! Though Commodore have announced their intention to market new 40-column versions of the VIC, these are in fact based on an entirely new Video Interface Chip. Though it is theoretically possible that someone could take this chip and market it in the form of a plug-in package, it is unlikely that Commodore will offer it as an upgrade as it almost certainly won't be a straight chip swop.

There is a 40-column add-on for the VIC marketed by B&B Computers and "approved" by Commodore, which also includes 32K of RAM and PRESTEL graphics as standard. But with a price tag of around £200 it represents a major upgrade. At the time of going to press, the 40 columns provided by the unit could not be used by BASIC.

Bits & Bytes

Perhaps you can help me – what it is a byte, bit and a word and how does this apply to the 1K of the Sinclair ZX81. What is the largest program that can be dealt with by the ZX81 and what are the limiting factors.

P. Oliver,
Walsall, West Midlands

A Bit (short for BInary Digit) is the smallest building block of a computer's memory system and can be in only two possible states: 1 or 0, that is 'True' or 'False' and represents the circuit being switched on or off. To represent any useful information, Bits have to be combined together, and eight of them in one package represents a Byte.

A Byte can store up to 256 codes and for storing data you would usually allow one byte for each character (A-Z, 0-9, punctuation and graphic symbols). 1K of RAM represents 1024 Bytes; 2K = 2048 and so on.

A Word is a term used mainly on much larger computers and represents a string of several bytes which can store a whole number. It has no relevance to your Sinclair ZX81.

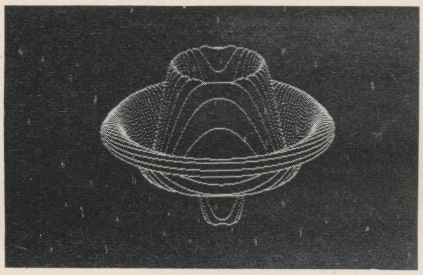
In theory, a 1K Sinclair could cope with a program of a thousand characters. In practice, a large amount of memory is used up for 'systems overheads', such as the screen and the variables needed in the program. On the good side, space is saved by the fact that BASIC keywords such as PRINT, INPUT, and LET use up only one byte each.

Tim Hartnell in his series on ZX81 programming has shown how to save memory with a number of clever tricks. The best way to discover how large a program can fit into 1K is to try out his various sample programs.

Impressive graphics

We were very impressed by Terry Hope's article on Atari graphics *(MicroComputer Printout* April 82), and admired particularly the high resolution three-dimensional plot on page 43. If only we could generate such pictures on our PETs.

But wait! I've just noticed a picture on page 11 of the SUPERSOFT Spring catalogue that looks vaguely similar. In fact....but that's amazing....it looks the very same photograph.



No doubt your readers would be intrigued to learn of this great similarity between the graphics capabilities of the two machines. Of course, the PET does need a SUPERSOFT high resolution graphics board to achieve such excellent results.

Peter Calver,
Supersoft,
Harrow, Middx

Ah...yes...well... we, too, are amazed at the similarity between the photograph Peter sent us and the one we printed. Perhaps some slip-up has occurred. No – that's impossible.

It just goes to show that computers are so accurate that they can come up with identical outputs even on different hardware (!).

Boffins exposed

The non-technical answer to Mr Pinless's problem with the VIC 20 (May 82) is simply 'to trundle down to your local TANDY shop'!

There he will find a 12ft extension lead, phono plug at one end and phono socket at t'other.

This will set him back approx. £1.60, but tell him to hurry as rumour has it that the Commodore intends to snaffle up the entire consignment!!

B. C. Wood,
(A satisfied VIC 20 owner who has to wear glasses anyway!)

Thank you very much for writing in, Mr Wood. Having confirmed what we have long suspected, that the boffins are really incomprehensible to anyone but another boffin, we have now seen the light and initiated a programme of, ah, streamlining.

(Editor's note: Mr. Wood's address has been witheld in the interests of his continued good health. Other readers are advised to exercise caution when contradicting replies given by our experts.)

Not-so-secret codes

I was amused by an article in last month's Hotline part of your magazine, the article in question being entitled "The Squeeze is on". I read it with more than average interest.

I sympathise with Mr Allason shuffling floppy disks around, having done it myself and I hope to shed a little light on an area which eluded his journalistic talents.

In the article we are told that E40 is based on the "statistical properties of English" which would appear to be alluding to a Huffman code system. (A who what code?)

A Huffman code is one where a code for a particular symbol is determined by the frequency with which that symbol is used; such that very commonly used symbols are assigned codes which are shorter (in terms of bits) and very rarely used symbols are assigned codes which are longer. The resultant effect of this is that a piece of text may be compressed to an apparent 4 bits/char. or 3.2 bits/char. which Dr. Andrews claims though he may well be using additional subtleties.

Encoding and decoding Huffman codes is an interesting problem since coded data is just a series of bits of data with no conceptual word boundaries. The system also has other problems: for example, if one bit slips in a file then any data following that slip will decode as complete and utter ****

This letter guesses at what Dr. Andrews has done (no, I'm not from Keele); should my speculation be correct then I wish him luck and suggest it is time we got round to using more ideas as old as this (1952) !

Yours,
Syd Student

P.S. "all 256 possible ASCII character codes": has inflation got that far?!

P.P.S. A reference book which explains Huffman codes is: 'Structured Computer Organisation' by A.S. Tanenbaum. Printers PHI. Relevant pages 38-41.

Atari query

I read with enjoyment your article on the Atari, but please tell me the difference between a 400 and 800 – is it worth the extra money?

G. D. Tatton-Brown
Devon

The major difference is in the keyboard – the 400 has a solid touch sensitive sculptured

READ/WRITE

The Editor welcomes your letters, but if you require a personal reply please enclose an S.A.E.

device, while the 800 has a full typewriter keyboard.

Though both machines include 16K of RAM memory, the 800 may be expanded with internal plug-in modules, up to a total of 48K. Other differences are relatively minor, except that the 800 includes a jack socket to connect (optionally) to a monitor rather than domestic TV set, thereby guaranteeing higher quality colour and resolution.

Our advice is that the 800 only really justifies the additional cost if you intend to use the Atari for business purposes, or intend to expand it to a full system with disk drives and printer.

Texan digits

Further to Mikes Muses (March 82) and the letter from Mr Bobler, I would like to point out that both of them base their generalised statements about 'Computer Accuracy' on old-fashioned eight-bit micros.

My TI99/4A gives me the right answers to all their examples and this brings me to my next point – why did your reviewer in the May issue not touch upon the numeric capabilities of the TI? Far from "keeping the enthusiast at bay", the highly accurate number crunching of the T.I. must be an additional attraction to the numerate computer enthusiast. After all, if a machine cannot perform basic maths functions accurately, it's not much of a computer, is it?

P.J. Haydon,
London N.W.1.

Well done, Texas! The accuracy of the TI99/4A's mathematics probably owes a great deal to that company's previous experience in pocket calculators, which are generally a great deal more precise than desktop computers.

For the majority of users, for whom processing is more important than calculation, however, most computers are accurate enough. Good programming always involves avoiding statements of the form IF A=B anyway.

Incidentally, Mr Haydon, accuracy has nothing whatever to do with having 8 or 16 bits; it is the Floating Point routines inside the BASIC interpreter which count.

Speedy Sinclair

I have solved the problem of using a cassette recorder with my ZX81 by fitting a bigger drive pulley on the motor of the recorder, uprating the speed from 1-7/8" p.s. to 3¾" p.s. Over a period of 10 days I have made 70 successful transfers from tape to computer with no failures, using the tapes I recorded 10 days ago. Of course it is necessary to record the tapes at the higher speed.

F. Woodgate,
Bracknell, Berks

We certainly wouldn't like to put our seal of approval on this solution to the cassette problems – our boffins thought it might create some side effects. Nevertheless, the proof of the pudding is in the eating and Mr. Woodgate says he has found a considerable improvement. Maybe our boffins are just confirmed pessimists...

Neater flowcharts

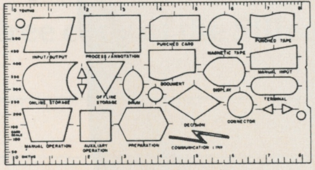
I have just read your article on Program Documentation in the May issue of Micro-Computer Printout, in which you mention that flowcharts are the easiest way to show how a program is going to run. This is a view I entirely agree with. In my present position, part of my duties is to explain existing software to new recruits, which I tend to do by drawing flowcharts; and this is where I hope you may be able to help.

The only flowcharts available in my office are NCC flowcharts which have about 5 symbols on them. About 5 years ago I had a flowchart (with the brand name LINEX – made in Denmark) which had not just the NCC recommended symbols, but most others as well, such as paper tape, card input, line printer output, VDU, etc. on it. Whilst these symbols may not be 'officially' recognised, they sure help in explaining the operability of programs to people new to the industry.

What I wish to ask therefore is if you know of anywhere that sells this, or similar flowchart templates; and if you do ,to send me any addresses please. In hopeful anticipation (my freehand symbols are terrible!), I await your reply.

D. Larder,
Loughton, Essex

Inmac Programmer's Template



Yes, flowcharts certainly are a good way of showing how a program will run – and a good stencil can produce a much neater result.

Though we don't know about the particular model you mentioned, Mr. Larder, several companies offer the kind of thing you are after. One such is the computer accessories people INMAC who do a programmers template for £5.20. You can telephone them on 09285-67551

Syntax errors 1

On page 37 of your May issue, Chris Preston writes that "the two symbols and are very easily confused." I couldn't agree more!

The symbols seem to be missing throughout the article; could it be that your word processor has a blind spot when it comes to these symbols?

B. Clarke,
Greenford, Middx.

Many apologies. Yes, it was the word processor, which we haven't yet trained to understand BASIC and other computer symbols. Full groveller and (hopefully) correct version appears in this month's episode.

Syntax errors 2

I was reading over the listing of ENERGIESIC, thinking about converting it to good ol' ZX BASIC, which I discovered to my horror that the listing on p.69 ended at line 4560 and on p.91 it started at line 10200. Where has the listing gone? Have the men from Windscale stolen lines 6000 to 6460 which are about the possibility of nuclear disaster? Has the Government censored the real truth found out by Mr. Walwyn?

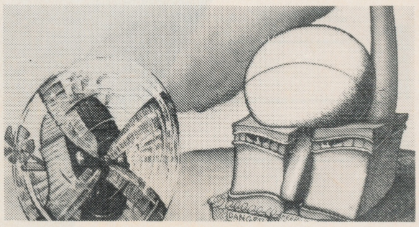
Please give us our listing back!!

I must congratulate Humphrey Walwyn on his excellent articles and hope he will write more in the future, and give all the readers an amazing new game. How about the one which simulates World War III mentioned in the March edition?

I own a ZX81 so please in future could you write your long programs in ZX BASIC? It would be very helpful to all my fellow ZX users.

C. Seltzer,
Giffnock, Glasgow

Oh dear, rather a bad month, the last one. Elsewhere in this mag. you will find the missing section from Humphrey's excellent program – prised, after a great struggle, from the men at Windscale.

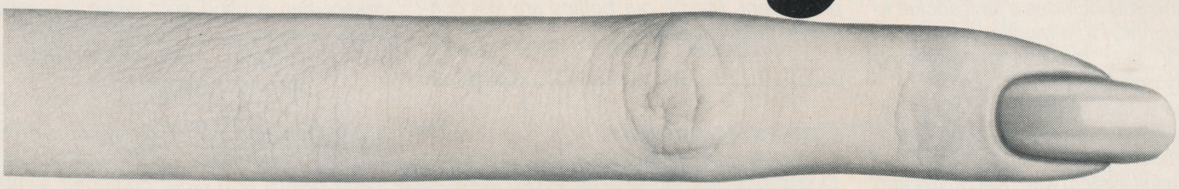


Much as we would like to publish a version of each of our main listings for each of the most popular machines, we do have a restriction on space, and Tommy, Inside Trader and the rest have objected to having their columns axed!

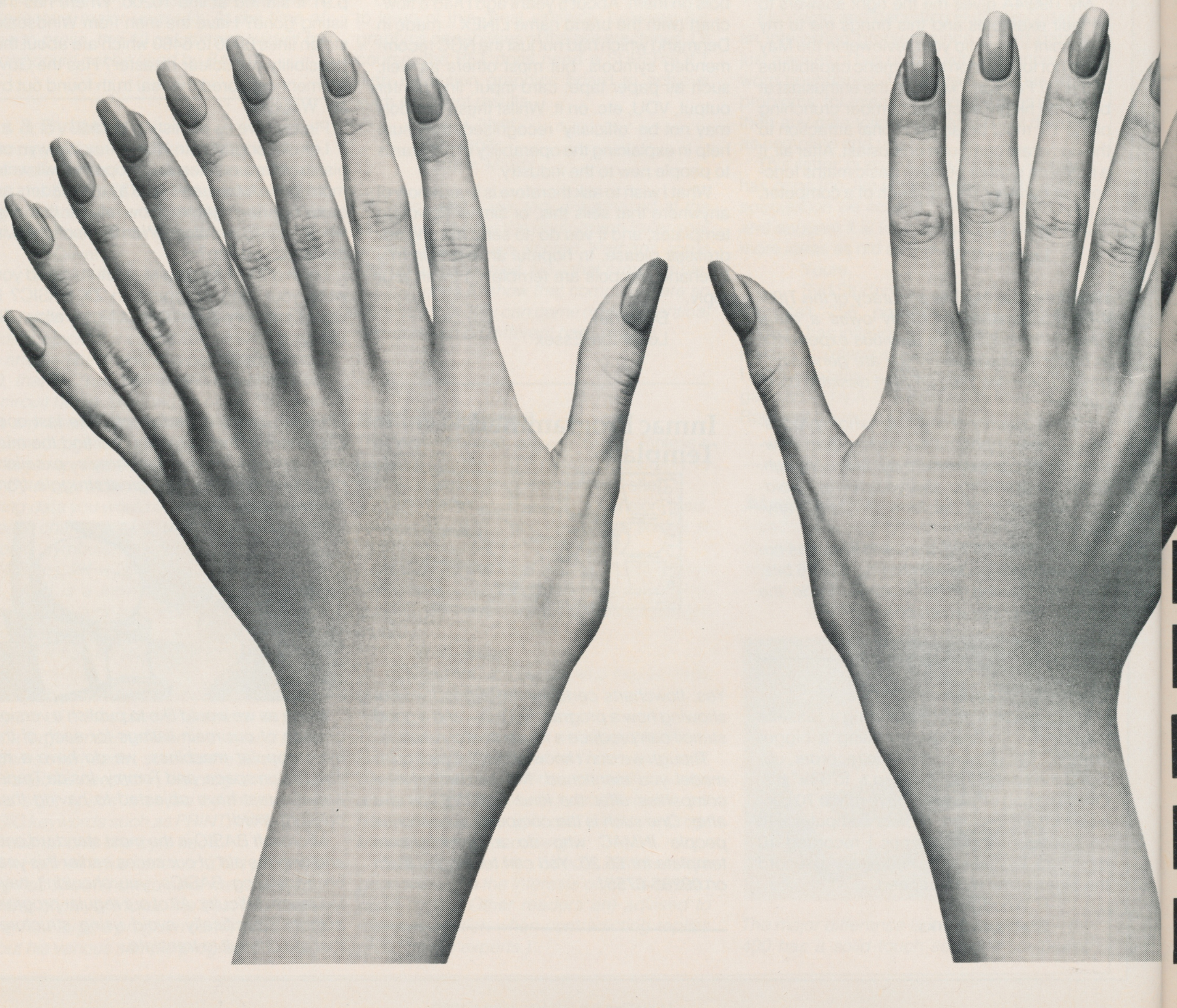
Microsoft BASIC is the most standard one, and with the aid of our series earlier this year on translating BASICs, you shouldn't have too much difficulty. All of our regular program authors specifically avoid using structures that are difficult to translate.

Now you can do al

accounting with...



without...



ll the filing, typing and

••

Silicon Office is the latest microcomputer software program from the Bristol Software Factory.

Designed specifically for use with the Commodore PET 8096, it'll help you run your office with the minimum amount of effort and maximum efficiency.

Think of it like three normal software packages in one, each separate package totally interactive with the other.

For around £4,500, you can have the complete electronic office, the solution to practically all your business problems. The price includes Commodore hardware, a high quality daisy wheel printer and Silicon Office software.

Silicon Office is made up from a flexible information management system which lets you create and maintain an extensive filing arrangement. Allowing you to search quickly through your records, making cross references between files in order to gain the facts you require.

A highly sophisticated word processing program allows you to generate letters, documents and reports. Letting secretaries get on with the more important tasks.

And a fully comprehensive calculator means you can handle all the number crunching you're ever likely to do in a business situation.

Leaving the accounts department to concentrate on more profitable things.

But that's not all by any means.

Silicon Office also has a special programmability feature which means you or your dealer can expand and tailor the Silicon Office program to your business.

When Silicon Office is used in an everyday business situation, certain command sequences are inevitably repeated. By writing short, very simple programs which are entered into the computer's memory, Silicon Office can perform the necessary tasks, automatically.

And last, but by no means least is an optional communications facility.

It doesn't take much imagination to see the potential of Silicon Office in virtually any line of business.

So to get a better grasp, send away for our brochure. It'll only cost you a stamp. And it could save you a fortune. Or talk to your local Commodore dealer who has all the facts at his fingertips.

You'll soon see how you're much better off with Silicon Office. Than without.

commodore
COMPUTER

PET
commodore
CBM
computer

I can't wait to get my hands on a free copy of the Silicon Office brochure.

B/MP 2

Name____________________

Position____________________

Company____________________

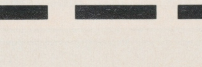
Address____________________

____

I own a Commodore PET (Please tick box) YES ☐ NO ☐

BSF Send to: Bristol Software Factory, PO Box 14, Horley, Surrey.

SILICON OFFICE



Not the BBC Micro

And now, Ladies and Gentlemen .... the moment you've all been waiting for .... the unveiling of the Sinclair ZX82. But wait.... what's this?....it's *not* called the ZX82? Will you welcome then – the Sinclair ZX Spectrum!

The Spectrum is not, it seems, a replacement for the ZX81 in the same sense that the '81 was for the '80 – and indeed the ZX81 will continue to be marketed as a minimal cost introduction to computing for beginners.

"We did consider calling the new machine 'Not the BBC Computer'", Uncle Clive Sinclair confided to your reporter. "Because what we have designed is far more powerful and far cheaper than their machine." Pause for effect. Large grin. "We believe that the BBC makes the best TV programmes in the world, but that Sinclair makes the best computers!"

Let's take a closer look. Are you sitting comfortably? Because Sinclair's competitors certainly won't be after they've read this.

The Spectrum offers colour, sound, high-resolution graphics, a proper keyboard, 16K of RAM memory, and a tape loading system that runs 7 times faster than the ZX81. The price is an astonishing £125 inclusive of VAT.

It is, to say the least, an awful lot of computer for the money, and if your computing intentions are serious, there's also a 48K RAM version priced at £175.

The Spectrum keyboard does indeed have movable keys of normal typewriter pitch. We are not sure that we would go along with Uncle Clive's contention that typists will rave about it, but it is a major improvement on the ZX81's membrane keyboard, nonetheless. Each key can have as many as five or six different functions, though skillful layout and use of colour has avoided the messy look.

Sinclair BASIC ("rapidly becoming the industry standard", according to Uncle Clive) has been used, with its system of one-touch keyword entry, and a system of new user-friendly commands have been added. INK, PAPER and BORDER, for example are used to control the foreground, background and border colours, with PLOT, DRAW, CIRCLE (and others) for the high resolution graphics.

The latter, which can use any two of the eight main colours, is very economical on memory so that 9K of the 16K is still available for BASIC, even with a hi-res screen. Users of the BBC 'A' machine would find themselves with only 2K of RAM left to play with.

Sound is fairly basic, with the keyword BEEP specifying both the tone and duration of a note.

The Spectrum has an expansion port on the back giving accress to the full control bus of its Z80A microprocessor. The ZX printer can be used – now with both upper *and* lower case incidentally – as well as an RS232 unit and a local area network system that will link a number of Spectrums (Spectra?) together.

But the peripheral which will really make you sit up and pay attention is the 1" disk drive (the whole unit is no bigger than a fist) which Uncle Clive hopes to market later this year for around £50. Yes, I did say *fifty* pounds. Capacity is 100K with a loading rate of 16K per second, and you can link up to eight of them to a single Spectrum.

There's not much doubt that Uncle Clive has once again succeeded in whipping the rug out from under the industry, and other manufacturers, notably Acorn, Commodore and Atari will, even as you read this, be giving serious consideration to their pricing policies. Expect those price reductions soon.

Thank you Uncle Clive.

***Editor's note:** Watch for our comprehensive Sinclair evaluation of the Spectrum in next month's issue.*

Technical notes: The Sinclair Spectrum is based on a Z80A microprocessor, with either 16K or 48K of RAM as standard. The casing, which measures 8½"x5"x1", includes a keyboard with movable keys and a UHF modulator. An external mains transformer is supplied and the Spectrum should work with any TV set and domestic cassette recorder.

The display can show 24-32 character lines of either text or graphics. Any one of eight colours (black, white, blue, red, magenta, green, cyan, yellow) can be used for the writing (INK), background (PAPER) and border. High-resolution graphics in two colours can be produced on a grid of 256x176 pixels.

R.P.

ZX Spectrum

Made in Budapest

I am reliably informed that sufficient money to buy a small third world country will this year be expended on the development of – what?

Think about it. What is it that the computer world most needs?

No, not more female members.

A very mini-floppy disk, that's what. Sony already have their 3" drive out in small quantities and sundry other Japanese and American companies expect to be in full production next year.

The shape and size of floppy disks to come?

Meanwhile the Hungarians have one now.

Yes, I did say the Hungarians. And they patented it as long ago as 1974. Or so I am led to believe by the mysteriously named BATS-NCI company who are about to start importing the darn things.

To further confuse matters BATS-NCI and/or the Hungarians, have chosen to call it a micro *cassette* disk...

Perhaps I had better start again.

A mysteriously named company with Iron Curtain connections will start importing an inexpensive disk drive based on 3" floppy disks from August.

These diskettes which are encased in a protective plastic sleeve can store 150Kbytes of information, and may be used in pairs.

Versions for Sinclair ZX81, VIC-20, PET, Video Genie and Luxor ABC 80 personal computers will be available from early autumn.

Unless my Serbo-Croat has entirely deserted me, the price quoted was 675,000 Zlotties. That's under £200. Could be quite a lot under.

You can get details from Budapesti Radiotechnikai Gyar, tel: Budapest 22-5451, or if you are using your own phone, 01-349 4511. The U.K. address is BATS-NCI, 375b Regents Park Road,, London N3 1DG.

Gasparjc Sprodje! That's Serbo-Croat for 'I am not kidding'.

by Julian Allason

Batteries & Bigger Disks for Briefcase Wonder

Osbornes on test at central London distributor, Digitus.

Nine foot tall micro guru, Dr. Adam Osborne is introducing battery back-up for his £1,250 *Osborne 1* computer-in-a-briefcase. Dubbed *Portable Power* the 4½lb rechargable battery switches in automatically in the event of power failure. It can also be used to provide an hour's computing in some of the more bizarre situations in which the portable computer is increasingly being used.

Double density kits that upgrade the floppy disks from 184K to 368K bytes of online storage will also be available shortly, priced at about £100 plus labour. Like the powerpack, it should be available in quantity by mid-summer.

Next month we'll be running a free competition with an Osborne 1 as first prize, so be sure to order a copy from your newsagent now.

If you can't wait, Adda Computers of Mercury House, Hanger Green, Ealing have a special offer that includes ten free diskettes, a year's maintenance and delivery anywhere in London and the home counties.

What's that about a discount? On a brand new machine? You should be so lucky.

Football Forecast

Professor F.H. George M.A.(Cantab), Ph.D., F.S.S., F.R.S.A. would like me to tell you about his new football pools program. This is what a good education does for you.

Prof. George is one of the country's leading experts on forecasting, so when he says the program represents 'a good long-term investment' we should pay attention.

On the other hand the Professor offers no guarantee of instant riches – or indeed any riches at all. So does it work? Apparently it does, although I note that the Professor is still driving his old Rover.

Successful pools forecasting demands maximum possible coverage of forecast drawn games within the cash available. The Professor's POOLPERM program produces a set of permutations ready to be entered on the coupon. For those with no time or inclination to forecast results, the program merrily generates random entries!

32K disk versions are available for Apple, PET, TRS-80 and Video Genie with 16K cassette versions for PET, Sharp, TRS-80 and Genie. They all cost £17.25 from the Bureau of Information Science, Commerce House, High Street, Chalfont St. Giles, Bucks.

With Tommy and all the other sponging hacks around I shall be marking my coupon with an X for 'no publicity'.

PET Pourri

Lord knows where Wing Commander Mick Ryan got time to compile the PET Index, but it contains an astonishing 2,200 references to articles about the PET from some seventeen computer newsletters and magazines. Including this one.

It costs £12.50 from Gower Publishing, Croft Road, Aldershot, Hants. A floppy disk version is promised shortly.

Another PET goodie I discovered recently is the *Keychip*, which adds a whole range of new functions that simplify writing and debugging BASIC programs.

Like screensave, screenprint, upward scrolling, user-defined subroutines, and some very superior listing facilities.

One of the nicest things about *Keychip* is that the suppliers have put rather more thought than most into packaging and documentation. Each *Keychip* comes individually boxed, with a well-written instruction book and self-adhesive labels to identify the function keys.

Keychip costs £15 all inclusive from Wirt Microsystems, 12 Alleyn Crescent, London SE21 8BN.

Instant Turn Off

What is it about Prestel that makes peoples eyes glaze over?

If you know the answer please let me know as I have news of some fascinating Prestel developments to impart, but the very mention of Prestel is enough to make most of you turn the page. I also undertake to pass the secret along to the marketing people at British Telecom who are at their wit's end (as usual).

Still with me? First, Tandata are launching a £190 viewdata adaptor with an RS232 computer interface that rejoices in the unlovely name of *TelesoftTantel*. With it owners of Apple, PET, Tandy and Sinclair computers will be able to upload and downlown programs from the Prestel Telesoftware database that is to come online this summer.

Tandata have another goodie in store: *Briefcase Viewdata*. Unlike normal Prestel adaptors, which are linked to a static jackpoint, *Briefcase Viewdata* can be used from any telephone in the country, thanks to a sound link via an acoustic coupler. The price tag is £449. Details from Tandata at Clyde House, Reform Road, Maidenhead, Berks.

British Telecom should give them a medal.

Cheeky Chappie

This month's missive from cheeky micro chappie, Derek Tidman of Work Force, tells how he is about to bring Nipponese giant Epson to their knees.

Tidman reckons Epson's replacement printer ribbons are priced on the naughty side. Besides which, having to throw the whole cartridge away when it is only the ribbon that needs re-inking, strikes him as downright wasteful.

The long and the short of it is that Derek's D.I.Y. replacement ribbons for the MX70, '80 and 100 models only cost £2.50 + VAT post free.

I have honestly no idea how good they are, as we haven't got an Epson printer in the office. But you have go to admire his nerve, especially when he adds a P.S. saying he doesn't think Guy Kewney has a sense of humour.

I understand that the doyen of computer journalists will shortly be paying a visit to No. 140 Wilsden Avenue, Luton to show Master Derek exactly what sort of a sense of humour he has.

HP Sauce

Nothing makes a computer manufacturer reach for his solicitor faster than the suggestion that his product is a trifle unreliable or a mite over priced.

In consequence some of the reviews you read in micro magazines grovel when they ought to be in there punching.

Last month I passed some distinctly negative comment on Hewlett-Packard's pricing policy. But instead of the usual threatening letter and cancellation of advertising space, H-P sent me a note.

The HP-85 Personal Computer has been reduced in price by 15%, it said, the new newly introduced HP-125 by a sizeable 27%.

I can't claim any credit for this – HP probably decided on the reductions weeks ago. But as ever, actions speak louder than words.

Telephone Robot

With networks and even Prestel now taking off, it looks as if telephone answering machines could well become the computer owner's second favourite bit of kit.

What a pity then that so many suppliers of telephone answering equipment appear to be crooked or stupid or both. (This view was recently born out in an investigation into the subject by *'What to Buy for Business'*.)

In the end we opted for machines marketed by Answercall Ltd., of 23 Mount Street, London W.1., which have proved efficient, and reliable despite the large number of silly messages with which they have to cope.

Now a company called Datavision are using this very machine in a novel way: to create, record and play back pages of viewdata.

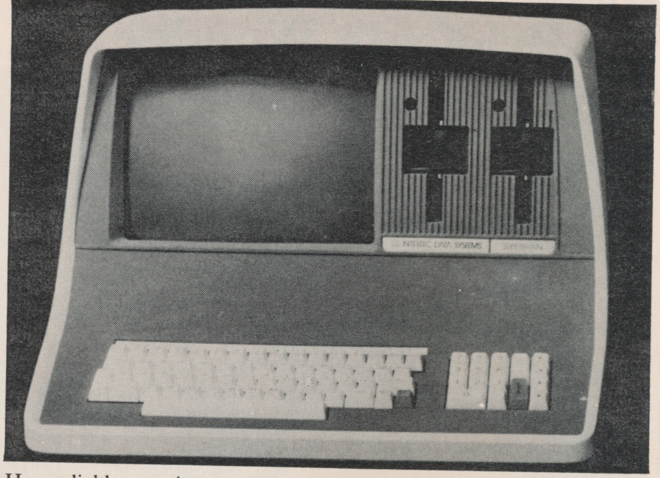
Here's how it all works. Datavision create viewdata pages for you for a modest fee of £2.50 or so per page. These are then encoded and sent down a telephone line to your specially modified Answercall machine. This can then be used to replay the pages on any viewdata TV receiver, or with an adaptor, on any TV set.

The system should appeal to anyone who wants to create a series of viewdata pages to show in-house or at an exhibition. And of course it is a very cheap way of doing it.

Other viewdata users can access the answering machine using the standard auto-dialler built-in to all viewdata and Prestel sets. The beauty of it is that the equipment can still be used as an ordinary answering machine.

Details of this £150 wonder from Datavision on 01-242 4268.

A bundle of trouble?



How reliable are microcomputers? Not a lot, if our experience is anything to go by. In case it wasn't I canvassed the views of a totally unrepresentative sample of the independent service organisations.

Which, I asked, is the least reliable brand?

"The component most likely to fail in any system is the disk drive," said Anita Business Machines service manager, Mr. Wilkinson, diplomatically.

But which, I persisted, is the worst?

"In our experience it has to be SuperBrain. Their disk drives have given trouble over quite a long period of time."

I got the same story elsewhere. "The SuperBrain's disk drives practically keep us in business," commented David Lines of Compufix.

According to SuperBrain distributor, KGB Micros, the problem is that the drive speed needs to be maintained to within 2% accuracy. "There is nothing wrong with the drives provided they are set up by someone who knows what they are doing," says Sandy Saunderson of KGB. "And in any case they have been a lot better recently."

Perhaps it is also a case of getting what you pay for, since the SuperBrain is remarkably inexpensive. Even more so since the beginning of May when the price was dropped by a further 10%.

So which then are the most reliable brands? Apple, North Star Horizon, Commodore and Sharp all seem to rate golden spanner awards from the servicemen.

"Commodore were atrocious to start with mainly due to poor quality control," says Lines. "They improved steadily until U.K. production was switched to a brand new factory in West Germany. There was a bad patch for a couple of months, but now it's fine again."

Teething troubles soon ironed out seems to be pretty much the pattern these days. But what about the Japanese?

Very reliable from day one apparently, and their chips (which appear in most American machines) are much less likely to fail.

What's your experience been?

Potent Pussy

Take a good look, because the chances are you will be the owner of just such a feline device as this in the near future.

The Cat acoustic modem links any computer with virtually any other over an ordinary telephone line.

Of course, there is a bit more to it than that (have you noticed how there always is with computers?) Especially if the two computers are of different types. To start with you need an RS232C interface, which is a standard feature on many computers these days. You'll also need a short program to smooth the way to satisfactory social intercourse: the computers have to be introduced first – with an electronic handshake, naturally.

Fortunately the Cat makes this a fairly painless process, operating happily in both 'Calling' and 'Answer' modes.

The receiver sensitivity is -45dBm which importers, CPU Peripherals, reckon is less likely to miss or misconstrue incoming signals under less than perfect conditions.

Just as well too, since 'less than perfect' describes reception conditions over our own telephones on a *good* day.

What bothers me a little is the price. Similar models are subject to heavy discounting in the States, and can be had for less than half the £249 price CPU have settled on. Doubtless they have had to convert for the UK phone system, but I think you can safely expect prices to fall once the competition hots up.

Meanwhile CPU can be reached on Walton-on-Thames 46433. Their address is Rodd Industrial Estate, Govett Avenue, Shepperton, Middlesex.

by Julian Allason

Just One Cornetto

Psst. Wanna buy the very latest in 16-bit computers? If you do, and you want one now, the choice isn't going to be too difficult.

Chances are you will find yourself inspecting one of two machines: the IBM Personal Computer or the ACT Sirius 1. Officially the IBM machine hasn't been released here yet. Unofficially KGB Micros of Slough and MicroComputerLand in London should be able to equip you with what's know in the trade as a 'grey import' for about £3000.

The Sirius is available through some two hundred ACT dealers priced at £2395, although something of a waiting list seems to have built up over the last couple of weeks.

Come autumn the choice of 16-bit micros could prove a lot more difficult. For one thing Olivetti, who claim more than half of all desktop computer sales (oh really?), will be in there battling it out with others. And they will be doing so with an interesting new machine, a large sales force and a massive promotional budget. So is it worth deferring a purchase til then?

As recently as last month my esteemed colleague, Inside Trader, ran an obituary for the Zilog's Z-8000 16-bit microprocessor. Despite the resounding popularity (Tandy, Sinclair, et al.) of their 8-bit Z-80 chip, the big computer manufacturers were staying away from Zilog's Z-8000 processor in droves, he wrote.

Olivetti beg to differ. So let's try and discover whether the new M20 Personal Computer is a Ferrari or a Fiat.

Stylistically – and Olivetti are noted for superb styling – it is something of a disappointment. One dealer damned it with faint praise: "It looks like a Japanese machine," he opined.

Inside it is a lot more interesting. For one thing the Z8001 chip drives a 16-bit data bus, unlike the 8088 based IBM and Sirius. So although it is usually held that peripheral chips (and that includes RAM memory) running off such a bus must be more expensive, Olivetti at least have the power of the 16-bit word length at their command. In plain English that *should* make the Olivetti significantly faster than present competition. As usual, however, much will depend on whether the software takes advantage of this.

RAM memory capacity starts at a handsome 128K bytes, expandable to 224K. The built-in mini-floppy disk drives offer only a less than state-of-the-art 320K bytes (unformatted) of storage.

Apple notwithstanding, it was at one time fashionable in Silicon Valley circles to scorn the use of colour in business computers. "That's just for kids" went the refrain. The recent success of financial modelling packages offering colour graphics facilities has done much to change that view, at least on this side of the Atlantic.

Olivetti have, wisely I think, decided to offer both colour and black and white displays. One interesting feature is that up to 16 windows can be created on the screen, for displaying alphanumeric and graphic information simultaneously.

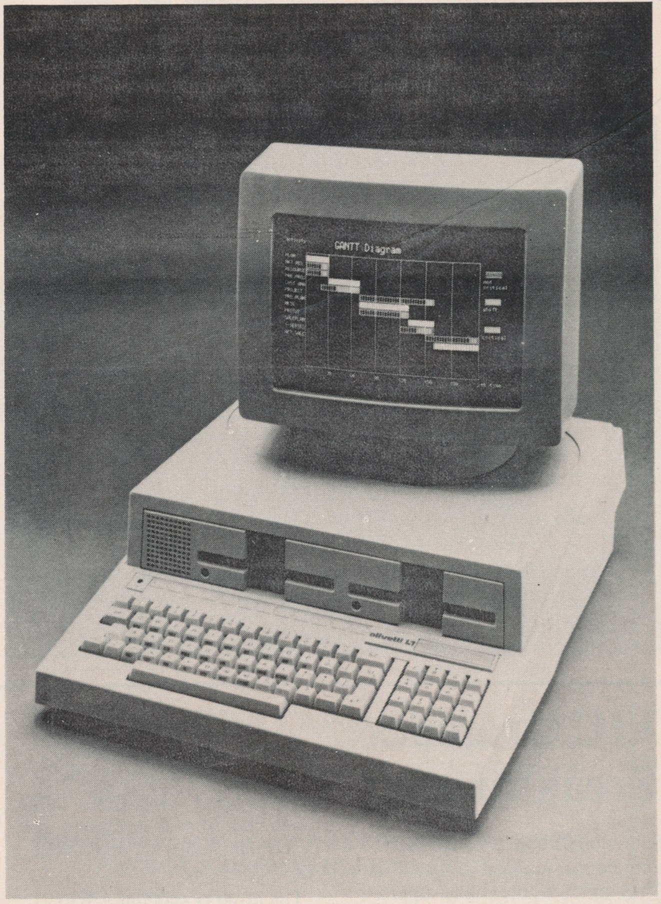
The computer is controlled by the PCOS operating system, about which I know little, and have been able to discover less. However, it does have an extensive HELP facility. Whenever you get into trouble, you type HELP and PCOS explains where you went wrong. That at least is the theory.

With the assistance of our friendly neighbourhood ice cream purveyor (thank you, Luigi), I have also been able to discover that the Olivetti M20 has Microsoft BASIC, and a choice of 25 lines by 80 characters or less usefully, 16 lines x 64 characters. According to Luigi it also has 512 x 256 pixie graphics...

I also notice from the spec sheet that the M20 includes "1 RS232C Centronics-like parallel interface – standard." Quite who was responsible for the documentation I don't know, for RS232C is a serial interface and Centronics a parallel!

So what are we to make of it all? My own view is that it rather depends on price. Knowing Olivetti, who recently quoted me an astonishing £3,995 for a mini-floppy disk drive and screen, the M20 could work out on the expensive side. On the other hand, Luigi is confidently quoting £2,395. Whatever the truth of it, I doubt it will make much difference to their sales though.

Just one cornetto please, Luigi.



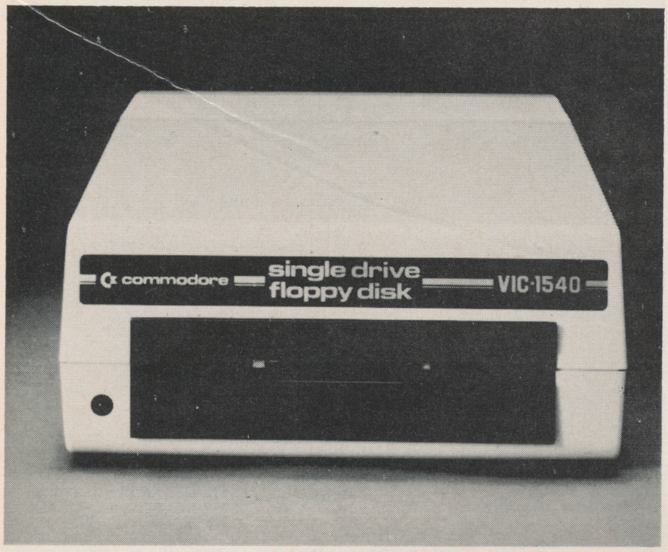
Presto! Apple into IBM

To the intense irritation of Apple, who greeted the jolly grey giant's entry into the micro market with a series of ads proclaiming 'welcome IBM' (we are not afraid of you), the latest Californian craze is for turning Apple IIs into IBM Personal Computers.

So far, two companies have announced 8088 processor cards that plug into the Apple IIs memory expansion slot. Once the *88Card* from Coprocessors Inc. or Metamorphic Systems' *Metacard* have been installed, the computer can run either standard Apple software or programs developed for the IBM Personal Computer and the Sirius.

US pricing around the $900 mark would probably translate to £600 or so here, once UK distribution is fixed up.

Win VIC Goodies!



I hope the Commodore has his wellies on, as I suspect he will be receiving a flood of entries for his new programming competition.

Here is how it works: you send your best home or educational program off to the Commodore before June 30th. A panel of judges headed by the VIC User Group's Boffin-in-chief, Mike Todd, wade through the entries.

The winners will be showered with VIC disks, printers, Programmer Aid cartridges and sundry other goodies.

There is also a special prize of a VIC disk reserved for the best entry from a *MicroComputer Printout* reader.

To stand the best chance, entries need to be both inventive and instructive. They should be designed for use as a primary, secondary or special school educational program or for home application.

The competition is open to individuals or group school entries and multiple submissions are permissible. All entries must however run on the VIC-20 or PET 4000 series computers. A condition is that Commodore will be allowed to market entries *in association with the originators.*

Be sure to use this coupon:

TO: COMMODORE SOFTWARE COMPETITION, 35 GARWAY ROAD, LONDON W2 4QD.
NAME: ....
ADDRESS: ....
....
POSTCODE: ....
ENTRY TITLE: ....
MicroComputer Printout

VIC Graphics Breakthrough

Sometimes I could murder the designers of low cost computers. They create a potentially superb system at an incredibly low price, and then spoil it by leaving out several almost essential features, that with only a little more work, could easily have been incorporated.

VIC, Atom and the ZX81, excellent machines in their way, all suffer from this ha'porth of tar syndrome.

Three cheers then for that gallant band of independent programmers who offer the missing features on tape or ROM chip.

One such is the redoubtable Arnold Lee of Abacus Software, P.O. Box 7211, Grand Rapids, Michigan 49510, U.S.A. For $30 (about £17.50) Mr Lee will supply VIC owners with what he modestly describes as "the most versatile graphics package yet produced for the VIC-20".

The GRAPHVICs tape or diskette offers the user both high resolution and multicolour display modes on any VIC-20 with 3K or 8K expansion RAM. It also gives you two screens, one for normal text, the other for graphics. You switch back and forth between them using the function keys.

On the graphics screen you have control over no less than 24,000 individual points! And you can mix both Hi Res and Multicolour modes on the same screen to create some spectacular graphics.

GRAPHVICS adds 18 new, and in my view, much needed commands to VIC BASIC. With them, drawing shapes and setting colours becomes much easier. You can even display text on the graphics screen.

The mystery remains – Why ever didn't Commodore put these features in in the first place?

Camp Computers

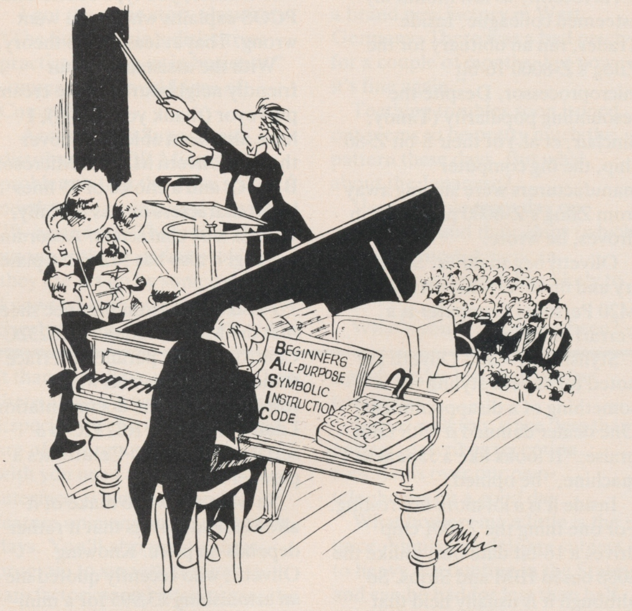
American parents have long understood the desirability of unloading their beloved offspring for a lengthy part of the school holidays. One of the favourite destinations being a 'camp', preferably one with vaguely educational overtones.

Computer camps have been popular for a year or two Stateside, but Dr. Lionel Wardle seems to be the first Brit brave enough to organise one here.

Dr. Wardle's camps run from July to September and cost £115 a week self-catering. And in case you thought that meant jolly sing-songs with pigs roasting over open fires, I had better tell you that the venue is the University of Southampton.

Would-be camp followers of any age can get more details from Management & Personnel Services, 37 University Road, Highfield, Southampton, tel: 0703-558621.

Don't forget to bring two dry sticks.



This gem comes from a useful new book entitled 'Start with BASIC on the Commodore VIC-20' by Don Monro. The cartoons, of which there are many, are by the estimable Bill Tidy. Appropriately enough it is published by the Tiny Publishing Company, P.O. Box 120, Haywards Heath.

Good value at £4.95.

Third Wish

In medical terms, a parasite is an animal which lives off another (usually larger) beast. In computing terms, it is a machine which can run all the software generated by a rival! The Video Genie is just such a machine (since it can run just about all Tandy programs) and importers, Lowe Electronics (0629-4995) have just announced a new model: Genie III.

Although the specification is not outstanding in today's terms (Z80A, 64K RAM, 700K disk capacity – expandable with external drives), Genie III does offer the benefits of an all-in-one integrated design, plus one or two distinctive features.

Built into the design, for example, is a CMOS clock with battery backup that provides true time and date to BASIC.

Most interesting, however, is a 192KB bank switchable memory add-on. These can be stacked up to turn the Genie into a multi-user system running under MP/M.

Which raises a moot point: is there any point in timesharing a Z80 when the speed will be drastically reduced and a terminal can cost practically as much as a stand-alone microcomputer?

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Yes. The PET Companion can be yours for just £6.75, that's £6.30 + 45p UK postage. But hurry – offer expires May 31st.

The PET COMPANION is a compilation of all the PET material published in the first volume of *MicroComputer Printout* including 105 PET programming hints and tips and 27 major articles on PET programming.

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A Beginners Guide

"Don't plug Commodore" said the man from Commodore. "Write us an essay that people will find useful instead." It was an offer I couldn't refuse.

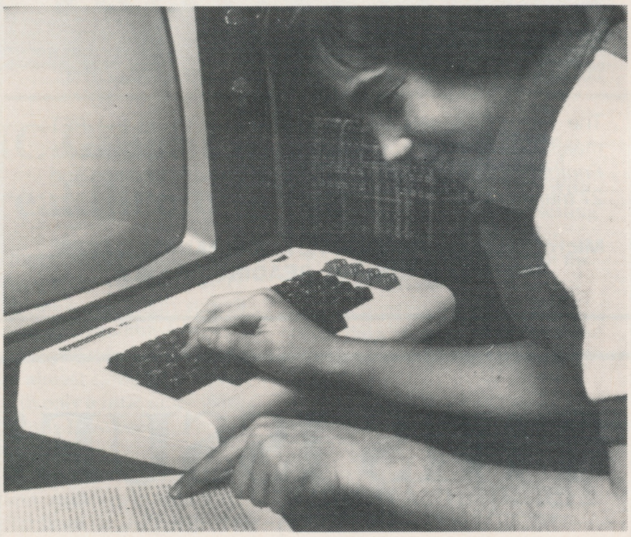
First things first then. Money. What do the darn things cost?

At Home

Anywhere between £70 and £7000. Maybe more. What you need spend is, of course, another matter. To a large extent you get what you pay for. But for a real computer that you can use at home the VIC-20 at £189 including VAT has to be a strong candidate. Why?

Colour graphics (assuming you have a colour TV) and a proper typewriter keyboard for a start. And sound. And plug-in program cartridges.

Budget another £45 for a cassette recorder to store your own programs; typing them in from scratch everytime is a real pain. It is likely you will want to add some additional memory to the 5K of Random Access Memory (equivalent to about 5000 characters of text) the VIC-20 arrives with. That's because only 3K is actually available for programming. Plugging in an extra 8K RAM cartridge will make a £45 hole in your pocket – but it will allow you to play Space Invaders!



Other popular and currently available home micros to consider are the ZX80 at £73, and the Atari 400 at £345.

In the classroom

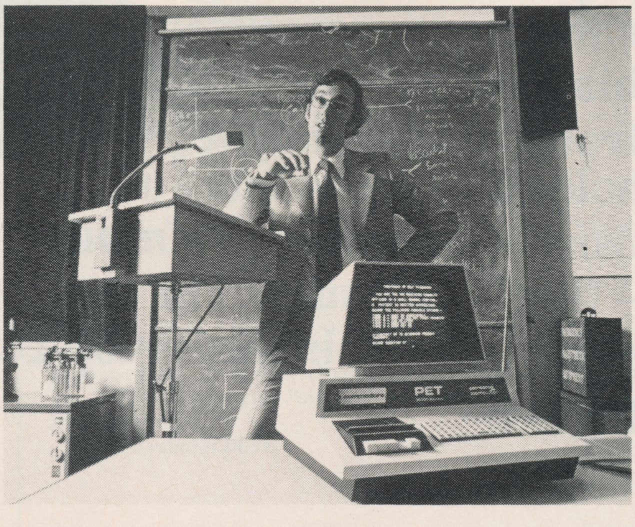
Schools have tended to opt for machines like the PET, the most popular choice, at £550 + VAT for 16K version, or the more expensive Research Machines RS380Z. For this you get a built-in black and white screen, for giving upper and lower case letters plus graphics. As with all Commodore machines, the BASIC language – very easy to learn – is built in.

The other major plus is the software. Lots of it available from independent suppliers. Commodore even give it away free if you are a school. Or you can swap with other teachers.

In business

Advising businessmen on the right micro is tricky; so much depends on the quality of the programs. In fact some experts recommend looking for the program first. Fortunately for Commodore I can put hand on heart and say that no system offers a wider range of off-the-shelf business programs than the PET.

There are a few businessmen that get by with 16K of RAM memory and a cassette drive – but not many. A more sensible configuration would be 32K of memory and a floppy disk unit. Quite a few companies offer this specification including Apple and some of the new Japanese machines.

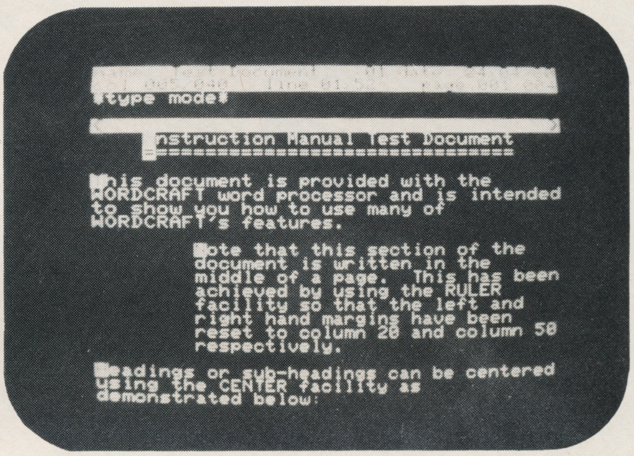


to Micro Computers

by C.R. Oppenheim

To give you an example of pricing, the 32K PET with 337K bytes (characters) floppy disks costs £1390 + VAT. The Apple price would be similar but with much lower capacity disks. Add £395 ex VAT for a dot matrix printer and you have a pretty effective business system for around £1800.

A good sales/purchase ledger package will cost around the £300 mark on the most popular microcomputers, perhaps twice this price on the others. Economies of scale you see.



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*type mode*

     nstruction Manual Test Document
     ===============================

 his document is provided with the
WORDCRAFT word processor and is intended
to show you how to use many of
WORDCRAFT's features.

               ote that this section of the
              document is written in the
              middle of a page.  This has been
              achieved by using the RULER
              facility so that the left and
              right hand margins have been
              reset to column 20 and column 50
              respectively.

 eadings or sub-headings can be centered
using the CENTER facility as
demonstrated below:
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Word Processing

Word Processing is probably the single most popular business application; it is so useful for sending personalised letters and maintaining lists.

After looking at more expensive systems I chose a SuperPET; its larger screen giving me lines of up to eighty characters long. Keyboard layout is QWERTY like a typewriter, so my secretary's happy too.

After the American *WordStar*, which runs on CP/M based machines, *Wordcraft* is probably the best known word processing program, and at £375 + VAT it has the merit of being cheaper. After careful consideration that is what I chose.

Whilst dot matrix printers, which as the name suggests create the letters out of dots, are fine for accounts, a typewriter quality printer is better for word processing. Commodore's new daisywheel at £850 + VAT looks like a bit of a bargain; if you are feeling rich you could pay £2000 for another make which would get through your letters even quicker.

Adding up the cost of a Word Processing system based on the 32K SuperPET with the powerful 1 megabyte disks (they store 1 million characters approximately, the length of a Dickens novel!), the price comes in around £3000 + VAT. That's including the software!

That's about all I have space for, for now. But if you have any queries, drop me a line c/o Commodore. Or alternatively fill in the coupon for further details and the name of your nearest dealer.

PET
commodore
CBM
computer
dual drive floppy disk
commodore

Send to: Commodore Information Services,
P.O. Box 109, Baker Street, High Wycombe.
Tel: Slough 79292

Send me more information about Home/Business/School Computing.

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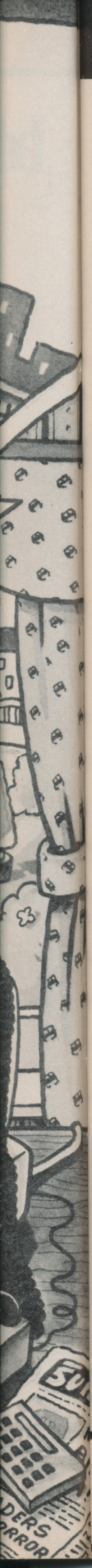
ELECTRONIC MAIL

DEAR JOHN
LETS CALL
THE WHOLE
THING OFF
DEAR JOHN
LETS CALL
THE WHOLE
THING OFF
IDIOTS GUIDE TO CP/M
ADERS HORROR

The idea of Electronic Mail – sending messages, letters and memos via telephone lines instead of post – is not new. But when will it become a reality, and who will supply the equipment? **John Gowans** discovered that PRESTEL may hold the key.



Dateline: New York 1929.
On the 18th floor of the Rickenbacker Building one sound broke the silence; a clatter and tap as paper unreeled in a slender stream from the mechanism beneath its glass dome.

The man in the pin-stripe gripped the tape in twitching hands, and read that his ship had headed for the open sea instead of coming in (to extend a metaphor). The only refuge from the dread words was the beckoning window ledge and the long, long fall into the Wall Street traffic....

No, I have not entirely taken leave of my senses. There is more to this little scene than the innocent enjoyment we get from recalling an earlier collapse of capitalism; viz, our captain of industry was a victim of electronic mail, or at least an early form of it. If news of the stock collapse had come in more sedately by US Mail – particularly with a second-class stamp – he might have had time to adjust, and go on to complete his career in some harmless dead-end job like being head of IBM.

The serious point is that electronic mail is by no means as new as some of our "gee-whiz-look-at-the-office-of-the-future" commentators would have you believe, and in fact most businesses around the world have been using one form of it for many years – not surprising since it was invented in the early 1900s. Guessed what I'm talking about? More later for the slow of brain.

Paperless office

But this old-fashioned stuff is obviously not what all the fuss is about these days. I mean, there will be no room in the squeaky-clean paperless office for a glass dome, let alone a clattery little mahogany-and-brass printer churning out enough paper tape to welcome a regiment of hostages home. What is this electronic mail business really all about?

We need a definition – and if you think I'm obsessed with definitions in these articles you are probably right. I have enough trouble stopping myself going off at tangents as it is, without ... where was I now ... oh yes, definitions.

As the name suggests, electronic mail is intended to do the job now being done, with varying levels of success, by Her Majesty's Royal Mails; only using computers, cables and satellites instead of pillar boxes, mail bags, and postmen on bikes. The postmen might object to being replaced by fibre optics, but nobody seems to be asking them. Electronic mail is definitely the thing of the future, the pundits cry.

But even before Sir Rowland Hill had figured out what colour the stamps for his Penny Post should be – he eventually demonstrated the same lack of imagination as Henry Ford and went for black – primitive electronic mail services were being set up. This was the late 1830s, and the technology being applied was that of the 'electromagnetic telegraph'.

Now don't mock. This was certainly the transmission of messages by cable over long distances – well, from Euston to Camden Town in the first instance, but much further than that in double-quick time – and to me that's a form of electronic mail. (Incidentally, this first railway telegraph was part-designed by Charles Wheatstone, whose Bridge ruined my 'O' Level Physics practical exam.)

Morse Code

The main purpose of early telegraphs was to help the growing railway networks handle their signalling systems and synchronise the times of various towns on the lines. And once Samuel Morse invented his binary code, using two or three bits for each character, the telegraph lines began to spread all over the world. Western films just wouldn't be the same without the villains trying to cut the wires while Doc, the genial old operator in the brocade waistcoat and green eyeshade, rushed to get the Marshal's message through to Tombstone or wherever.

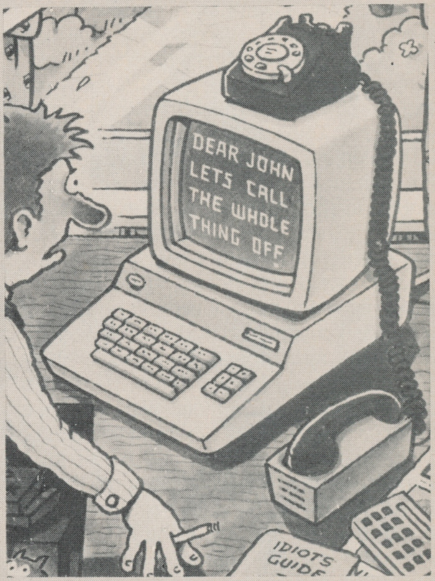
But if you are not satisfied that this counts, let's go back to that 80-year-old electronic mail service that everybody is still using. Yes, it's the very wonderful Telex network.

This was developed by a gentleman named Frederick Creed, and the company he founded still makes teleprinter equipment under the wide umbrella of ITT. There can be no dispute about this; it is a complete network linking over 1,000,000 locations in 200 countries, over which text messages are sent direct from one Telex terminal to another. Orders, invoices, stock information, and other things like press releases (ask the Editor) are routinely sent by Telex for fast response, with only the tidied-up written confirmations being entrusted to the mercies of the Post Office. Entire business transactions are often completed without a single envelope changing hands. Electronic mail? Certainly.

> **"electronic mail is by no means as new as some of our 'gee-whiz-look-at-the-office-of-the-future' commentators would have you believe..."**

Another elderly form is facsimile transmission, usually abbreviated to 'fax', which was first demonstrated – wait for it – in 1842, using the telegraph as a carrier. Fax is simply a way of duplicating a piece of printed material, which can be a document, a photograph, one page of a book, or anything else, coding the image information, and squirting the coded data down the wire. At the other end the code is used to drive an image-producing printer, and there is your duplicate.

And until very recently, that is where the matter rested. Telegrams, Telex and fax were the only methods of electronic mail available from the beginning of the century up to the 1960s. And then came cheap computer technology, and it all started to look a little passe my dear. The defects of the ancient three suddenly stood out like a top hat on a monk.



Network failures

First of all, telegrams were just not suitable for long and complex messages, and still had to be enveloped and delivered by the GPO. Then Telex, a bona fide electronic mail service, was slow and unreliable; the standard transmission rate is 50 bits per second, and the success rate of transmissions can be as low as 25% because of international network failures, shortages of lines, or unavailability of somebody to take the message at the receiving end. And fax was slow to originate, slow to print at the far end, and slow to transmit if a decent high-resolution duplicate was to be produced at the end of the process.

Considering the operating speed and fast communications possibilities of the new generation of office computers, if electronic mail was to happen at all it would be necessary to re-think the methods and the media involved in carrying it. And this was in the hands of the national Posts, Telephone and Telegraph authorities, the PTTs.

In Europe, the PTTs have enjoyed a favoured position in the telecommunications business, completely unlike the position held by Ma Bell (American Telephone & Telegraph, to be more formal) in the US. While the US anti-trust rules practically force AT&T to allow competition in providing telecomms services, the European PTTs have enjoyed cosy monopolies in their own countries and are still jealously guarding them. Whatever the rights and wrongs and reasons of this position, it is certainly the case that the monopoly power of the PTTs has slowed down the introduction of electronic mail services on this side of the Atlantic. The position now is that all the technology is ready, and waiting for the PTTs – the telecomm medium providers – to get into gear. The waiting is necessary because the PTTS have a stranglehold on the public communications networks, and private firms are just not allowed to compete by laying networks of their own. Except, that is, in the UK since the Telecommunications Bill became law last year; and we can expect much faster movement from British Telecom from now on.

More on the UK's monopoly-busting later. But what is all this electronic mail technology that is hanging around the place waiting to be used? And how – getting to the point at last – does the microcomputer fit into the picture?

As we saw in an earlier article in this series, about networks, there is nothing new about computers communicating over PTT and private lines – remember, private lines are permitted if they only link different parts of a single company. But these were and are batch communications, where one computer builds up a big lump of data and then sends it to another all in one go. This method is fine for things like sending local financial data along to head office every day, since the line time you have to pay for is reduced, and reduced even more if the batch is sent over the line during off-peak telephone hours. Again, if a fixed time of day is set for the batch transfer, the receiving computer can be set to be ready for it.

Person to person

Every letter-receiver knows that ordinary postal mail does not work like that. True, your letters do arrive through the letterbox in a batch. But some days you get a lot, some days none; some days the post arrives at one time, and some days another. The thing about mail is that you cannot anticipate its arrival precisely. Another thing is that ordinary mail is place-to-place rather than person to person. If you aren't at home when the post arrives, there is no way to get at it until you get back. In electronic mail, Telex is like this too.

But electronic mail can do better. The computer-based message system, or CBMS, is a true person-to-person mail system. On a CBMS, what happens is that the sender of a message transmits it from his or her terminal to a computer which has a set of 'mailbox' files, one for each user of the mail system. The sender puts the message in one or more of the mailboxes, depending on the circulation list of the message, and then gets back to work. Eventually, the intended recipient(s) will dial into the system, check the mailbox or boxes, and get the message.

In this kind of system, people can 'pick up' their mail when it suits them and reply immediately by composing a message on the terminal and putting it into the appropriate mailbox files.

In the US, CBMS is a big growth area. The service is offered as a kind of bureau service, where subscribers pay the provider to get their mailboxes onto the bureau's computer and receive dial-in facilities. Examples of this kind are Comet, from Computer Corporation of America, Telemail from GTE, Augment from Tymshare, Scrapbook from Triad Computing, I.P. Sharp's Mailbox run from Toronto, and Computserve's Plexus. At least two of these, Comet and Scrapbook, are available in Europe as software packages for companies to run on their own minis and mainframes; but this is only for communications inside the companies who invest in it – the PTT monopolies strike again.

Even so, it is this kind of system that gives the common or garden microcomputer user a chance to get into electronic mail. For a long time now, it has been possible to plug a micro into the public telephone network through an acoustic coupler or modulator/demodulator (modem, dummy), and so swap data with another micro so equipped. But unless you are prepared to leave your machine permanently switched on, just in case a message comes through from someone – make someone happy with a modem – direct electronic mail is out. Even worse, communications tend to be a 'foreground' activity on micros. That is, while you are communing with a like-minded spirit over British Telecom's accomodating lines, you can't do anything else with the machine.

The mailbox is great for micro owners; you switch on, dial up, and see if anyone has answered your ad for 'like-minded computer freaks, into Led Zep, Police, hang-gliding, self-inflicted wounds and the IEEE 488 bus' by checking your box.

Information services

This has long been recognised in the US. In typical subversive style, the microcomputer underground over there set up its own CBMS services for home users rather than the moneyed conglomerates. The best-known is The Sourse, based in McLean, Virginia – but believed to have no connection with the other well-known Virginia outfit, the CIA in Langley. Set up on a shoestring, The Source is now a respectable organisation owned by The Reader's Digest Association Inc., and claims to offer 1,200 information and communications services.

> **"ordinary mail is place-to-place rather than person-to-person. If you aren't at home when the post arrives, there is no way to get at it until you get back."**

The first one they mention, though, is SourceMail, a mailbox CBMS. Any Source subscriber can leave messages for any other – it beats Dateline any day – and the central mainframes will even correct your spelling errors for you.

Another US service, Micronet, comes from Compuserve. This firm is one of the major bureau service providers over the Pond, and has already been mentioned for its big-company mail service. But Micronet gives the subscribers the same sort of services as The Source, this time from Columbus, Ohio.

There are various other such services available in the US for micro owners, mainly because there are such a lot of them there.

If you are getting fed up with hearing about the wonderful things that micro users can get in the US – and I know MicroComputer Printout's Editor is, since he has written to me telling me to stop making his mouth water – rest easy. The UK has one big advantage when it comes to mailbox electronic mail, and that, oddly enough, is one of the country's prime white elephants after Concorde. That's right, it's Prestel.

When Prestel was first launched – and although my youthful appearance may tell you different, I started my writing career doing manuals for Prestel interface chips – one of the features the engineers emphasised was the message-leaving one. The owner of a Prestel set, they carolled, could leave 'happy birthday' or less complimentary letters on a particular page of the Prestel computer for the other user of a Prestel set (there were only two at the time; I believe there are three or four now), and these could be read off the screen by the recipient when he called up the right page.

Eurocrats

Prestel is, in fact, a nationalised Source and can provide all the facilities that the more famous service can. If, that is, yer average micro owner can buy a Prestel interface cheap; and there are signs that these interfaces are on the way. Leaving the BBC Micro aside – and I've just heard from a customer who has had his BBC monitor delivered without them having any record of a computer order to go with it – the leader is Tandata Marketing, the Tangerine Computers spin-off that is cleaning up on teletex adaptors for TVs and micros. Teletex, by the way, is the revolting term dreamed up by some Eurocrat to cover Ceefax, Oracle, Telidon, and other broadcast information services. The same Eurocrat calls viewdata videotex, for reasons which escape me.

But I digress (again). Companies like Tandata, B&B Computers, and Kirby Lester are actively producing videotex (ugh!) interfaces. And if you buy one of these, electronic mail is waiting on the Prestel computers.

Even after all these years – perhaps it was my manuals – Prestel is not exactly a success. But the UK is not an electronic desert, and Source-like services are springing up with electronic mail as the prime reason. There are two Forum-80 services, one in London and one in Hull (did you know that Hull still runs its own telephone system? Perhaps this explains the two sites...) on 01-286 6207 and 0482-856169. There is, to offer yet a third telephone system, also a Forum-80 in Holland on 010 313 512 533.

Then there is 80-Net, run by the TRS-80 Users' Group from 0908 566660.

All these are privately-run systems, with no Reader's Digest or other big name involvement. Which is just as well; I would always expect The Source to cut my 18-page letter down to three-word moron level.

But the European PTTs are not letting the private boys get away without a fight. The monopolies still hold in all the European countries except the UK, where British Telecom is being pushed into competition for the first time since the 1940s, but the electronic mail push is coming from the Deutsche Bundespost, Telecom's West German equivalent. The name of this new game is Teletex – not the Eurocrat's renaming of teletext but a re-vamping of the geriatric Telex network.

Incompatibility

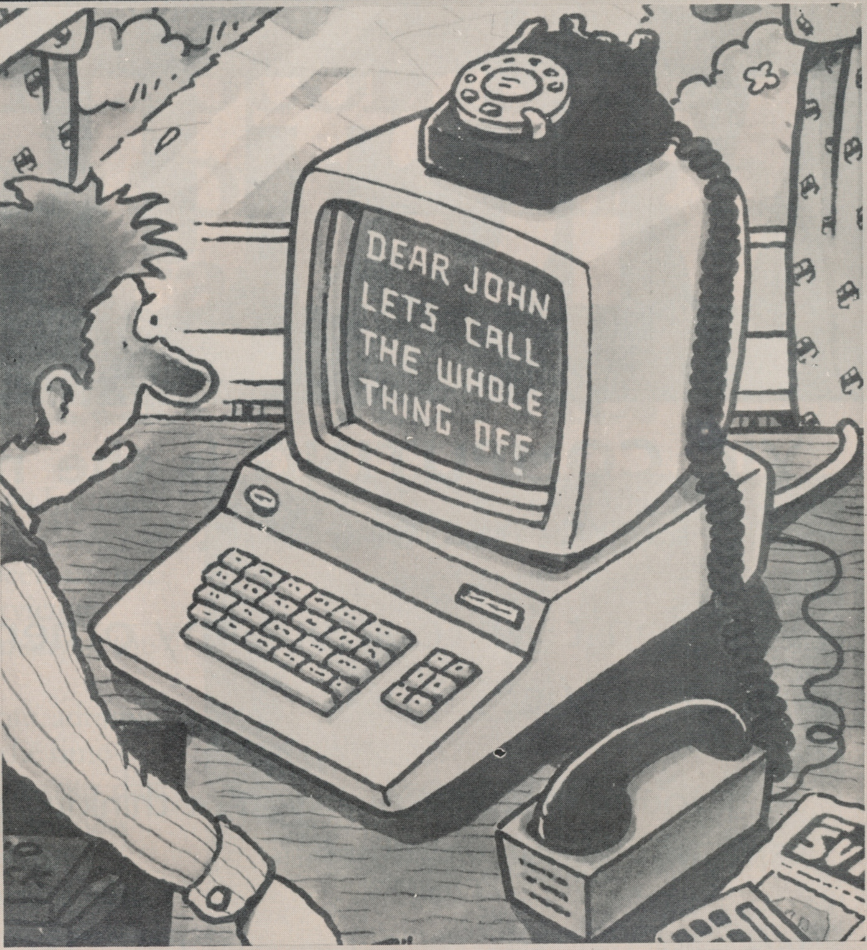
The plan is that Teletex will provide an electronic mail facility for word processing systems, whoever makes them. Most word processors sold today claim to be communicating word processors – that is, able to send created document files to another system – but this is misleading. Al Dunn of the Yankee Group, a top market research outfit in the US, reckons that out of 53,000 installed 'communicating' word processors in the US only about 10,000 do any communicating at all. According to Dunn, this is because of incompatibility between the word processing systems from different manufacturers combined with users' reluctance to move into sophisticated office communications.

Teletex can help. The CCITT, which are the French initials for the International Consultative Committee on Telephony and Telegraphy, describes the service as "enabling subscribers to exchange correspondence on an automatic memory-to-memory basis via telecommunication networks." The important part of this is the 'memory-to-memory' bit, which means that Teletex is a background communications system. The message is read straight into memory, RAM or disk, without interfering with the current processing task.

Also important is the speed; 2,400 bits per second is not bad compared with Telex, although the present top rate is 9,600 over voice-grade telecomm lines with 16k bits per second modems in the pipeline.

This kind of system is not based on the mailbox principle – or at least, not directly. Like Telex, Teletex is a terminal-to-terminal system that does not require the user to dial somewhere else to get his messages. But the background communications features give the same effect, since the user can happily tap away at his word processing terminal until a lull occurs, and then check in the memory in case a message has come in.

The PTTs are recognising that electronic mail gives them a big chance to use their well-established networks more efficiently and give themselves a shot in the arm at the same time. British Telecom could do quite well as it was; to get into The Source for example, a user had to go through BT's IPSS (that's International Packet-Switched Service) at Kew Bridge. This caused some complaints from UK companies who had put databases on Lockheed's giant computer system in California, only to find that prospective paying users could not get into it because the IPSS waiting list was full.



Fibre optic links

Now, the monopoly has gone and the first beneficiaries seem likely to be Cable & Wireless (ex-nationalised), BP (ex-seminationalised) and Barclays Bank (would not touch nationalisation with a barge pole). Project Mercury, the joint venture between these three, will compete with BT directly in providing electronic mail services over fibre optic links laid by the side of British Rail (nationalised) lines. Unless BT gets its act together on Teletex – and that relies on the supply of suitable terminals from outsiders like Philips and Siemens – the private sector will rake off the cream of the business traffic.

For the micro user, most of this is optimistic. The services are coming to give him electronic mail services on the mailbox principle. But watch out for companies offering electronic mail software – all too often it will be the usual communications software that allows a micro owner to get into the telephone network. Electronic mail is not far enough developed for specialist micro packages to be developed; sorry, particularly for the manufacturers I've just slagged off, but there it is.

"The PTT's are recognising that electronic mail gives them a big chance to use their well-established networks more efficiently and give themselves a shot in the arm at the same time."

If you can't get into Prestel, you should perhaps consider the archaic Telex network for electronic mail. Encotel has an interface into Telex for the Superbrain – wonderfully misprinted Superbrian in a recent 'other publication' – and Transdata has a multi-various Telex interface on its shelves. But if Teletex is close, hang on. The Telex code only has five bits, called the Baudot code, and cannot handle complex things like lower case. Teletex gives you more, faster, and... it's bound to be incompatible with just about everything.

Let the big companies keep their intelligent photocopiers, store-and-forward telex terminals, local area networks, and digital private branch exchanges. What we need more of are Source-like systems that will take messages as easily as the ragged-trousered urchin used to in my father's day.

With an acoustic coupler or modem, you should be free to paraphrase McLuhan; "the medium carries the message – and the PTTs had better get their fingers out." I'm sure McLuhan would have approved.

VICTUALS

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THE BBC MICRO FILE

The BBC Microcomputer, which we evaluated in our March issue is truely an amazing machine from the technical viewpoint. But its real significance and impact has nothing whatever to do with design. Guy Kewney explains why.

The BBC Microcomputer is a controversial machine, and was always going to be. And anybody who tries to find out why had better start by drawing up a list of points. And an evaluation of the machine itself should be so far down the list that you never get to it.

The BBC machine is not about technical points, no matter how much you may like the machine or dislike the machine. It is all about recognition, and recognition is the one unforgivable achievement. Nobody really begrudges his rivals a living, no matter whether it is a good living, or even a better living than he is getting. Indeed, I know several people who will happily tell tales of how some rival won a contract, or made a sale, or signed a deal, and they will tell the tale as if the success just proved how lucky a real fool can get.

But let that rival get the Queen's Award for Industry, and out come the bank statements, the secret orders with overseas customers – anything to prove that the award would have been better deserved elsewhere.

Sniping and gossip

Acorn makes the BBC microcomputer. Acorn has, as a result, a good chance of becoming a big, successful microcomputer company, and you won't hear many grumbles about that. But the fact that Acorn got the BBC contract means more than success – it means that Acorn has made it. Acorn is famous – so famous that it isn't even mentioned once in the BBC's *Computer Book*.

And Acorn is fair game for sniping, for gossip, for any opinion you may care to offer about it – because somebody will listen, fascinated. After all, the people you are talking about, when you talk about Acorn, are people who are Connected To The BBC!

So it is that you will hear fascinating stories about how Acorn got the rights to build the BBC micro.

You will hear (and it is true, as far as it goes) that Acorn hired the man who was the BBC's Micro Consultant – he was then a teacher – after he had first agreed to join Apple, and then decided to join Acorn instead. And, naturally, you will hear that that is why Acorn got the BBC deal.

You will hear that Acorn got the agreement to have its earlier machine, the Atom, approved as one of the official schools micros, by similarly smart social-business moves.

On the other side, there are people and companies who might have made the BBC micro, but didn't. The best known examples are companies called Tangerine, Transam, Newbury, and last but far from least, Clive Sinclair's company, Sinclair Research.

From these people, you will hear that the reason they didn't get the contract lay in the fact that people in high places were jealous of them, that they were asked to do too much, that they agreed to do things but still got left out, and that the real problem was the colour of their eyes.

If you want my opinion, which admittedly didn't count for much when the BBC mandarins were weighing up the various options, I would say that it wouldn't have mattered very much if the BBC had chosen the Sinclair rather than the Acorn Proton as the basis of its central processor unit (CPU).

Bandwagon

That is, it wouldn't have mattered much to the BBC or the people who watched The Computer Programme on television, or the people who bought the BBC microcomputer. Things would have happened differently, but in the long run, the BBC micro must succeed just because it is the BBC micro, because the program will lead to sales, and because everyone will jump on the bandwagon eventually.

However, it does matter, a lot, to Sinclair and Acorn.

The most important thing about the BBC micro itself is the fact that there will be thousands and thousands of the thing. Not many people really grasp how important that is.

Take the Sinclair micro, the ZX81, now probably the best known computer in Britain. It is dismissed as an "educational toy" by many. It is categorised as a "programmable calculator" by others. It is "not really a computer", most people agree, especially those who don't really know what a computer is.

But early this year, there was a Sinclair Fair in London.

On the face of it, a Sinclair Fair is a stupid idea. Unlike a PET Show, where hundreds of

dealers can come and set up stands, the Sinclair Fair could only attract one dealer – Sinclair's mail order department being the only place to buy the things apart from W.H. Smith.

In the event, as I commented to a colleague who is launching a magazine called *ZX81 User*, there were 60 different companies there, all selling things to add onto, plug into, wrap around, put underneath, or be controlled by, a ZX81. "In fact there are 120 such companies that we know of", he retorted.

That was in February, less than a year after the ZX81 had been launched. All those products had been developed, the companies (mostly) launched, and the market started, in only nine months.

And those products weren't just Space Invader games, either. They ranged all the way from Memotech's ingenious method of expanding Sinclair's 1024 byte machine till it has a 65,536 character memory, through a joystick add-on, to "play games", to RD Laboratories and its system for turning the ZX81 into a laboratory control module – for around £100 (or less) on top of the normal price, plus people who add on disks, proper typing keyboards, printers, and so on.

Business opportunity

People who talk about the money to be made on "up market" machines should reflect on the fact that if all these 120 people stay in business, then the number of upmarket Sinclair machines will probably be more than the total number of other upmarket machines all put together, in a year or two – simply because of the number of potential customers. Over half a million ZX81s in service, and every fault a business opportunity for somebody else, folks!

The BBC's theory that it needed a system which could be expanded and would last and last, won't really stand up against that sort of demonstration of the power of sheer volume. And sheer volume arises from cheapness, not excellence – or else we would all use Hewlett Packard 125 machines.

On the other hand, Clive Sinclair has a theory that his machine, a slightly modified ZX81, would at least have been ready for customers at the time when the Computer Programme began broadcasts.

This theory, equally, I can find holes in. It's the sort of theory you have when you are a powerful personality, accustomed to getting your own way fast as Sinclair is. Whether the theory would have prevailed against the BBC's corporate functions is quite another question.

Clive's opinion is that the BASIC on the ZX80 and ZX81 is evolving along a much more sensible way than the BASIC which all the other people are getting by working from Microsoft's MBASIC interpreter. I think he has a point or two.

First, Sinclair BASIC checks what you type in as you type it, to see if you are typing BASIC or rubbish. Most Microsoft BASICs don't prevent you from typing the most appalling rubbish as serious program entries. It isn't funny either, because while you are entering programs into a BASIC machine, any information following a number is taken as an instruction to be stored. Bash the number 6 with your elbow while answering the phone, then lean on the keyboard with your coffee cup, and it is all too easy to find that line 666 @#$%$%$∝√&*()]+ is now part of your BASIC program. Tough if line 666 was actually a complex algorithm you only just got working – 'cos it's gone, now.

BASIC faults

Run a Microsoft program, and it'll pick up the problem. Syntax error line 666 it'll say, quick as quick. And on the flashier ones, you get line 666 there to edit, too. Correct it, and the program is ready to run ... no it isn't. Syntax error, line 675, it says smugly. BBC BASIC has some of these faults.

I like Sinclair BASIC, and it will evolve – in fact by the time you read this, a new version of it might have been announced. Nine months is usually what Sinclair allows a product before he regards it as going stale and produces something better.

The fact still remains, that Sinclair BASIC would have been manipulated by many hands before the BBC would have accepted it. The theory was that the BBC machine had to have lots of software ready to run when it appeared. So, as far as possible, BBC BASIC was adapted from its first rather strange form into one that would, with a minimum of programming effort, allow PET, Tandy and other Microsoft-like BASIC programs to run almost unchanged.

The same would have happened with Sinclair's BBC machine, and also there would have been helpful insistence on extra features such as games paddles, and standardisation, which would have guaranteed that the Sinclair BBC machine too, would have been late.

Frankly, that the BBC machine has appeared at all, is a bloody miracle. This time last year it was little more than a paper design for a next-generation Atom, and the BBC seized it with grateful hands when they realised that the Newbury machine which they'd picked first, just simply wasn't going to be built.

Other rivals, Tangerine and Transam, had problems of size and organisation which turned out to be temporary, and but which at the time did frighten the BBC's decision makers. So Acorn got the prize.

Confusion

The history of the machine so far is mainly a history of opinions. Whole articles have been written by learned academics, based on a half-understood reference to tentative plans for the machine's earlier Newbury incarnation. Whole further articles have been based on the confusion that subsequently arose.

The fact of the matter is that we still haven't the faintest idea what sort of machine the BBC cpu (or BBCPU, if you like) will be.

So far, we know that it is quite cheap compared with the current Apple, but that the price has actually risen, and that Apple is planning a new, cheap version with similar features – and Commodore have recently announced a whole new range of products aimed at the same market.

So far, we know that it is probably the most sophisticated system in the world at using ordinary audio tape cassettes to store programs and text. But we just haven't a clue how well it will cope with diskettes, because its Machine Operating System still doesn't use them (because there still aren't any). So, while it may be nice and kind to users, it may also turn out to have some fundamental flaw. You know, like CP/M's habit of stopping in the middle of a program, proclaiming disdainfully that it's gone off the diskette which it has been using (the phrase it uses is "Bdos Error on B:R/O") and junking all the data in memory together with the program while it goes off and sulks.

I'd put a bit of money on its operating system myself, because I know the guy who's writing it, and I know his past record on using diskettes – but my bets don't prove anything. And in the meantime, there are lots of other things happening.

First and foremost of these other things, is the Commodore VIC.

Selling 10,000 a month by now, the VIC sells for under £200 rather than nearly £300.

BBC MICRO

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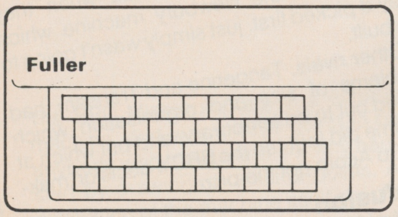

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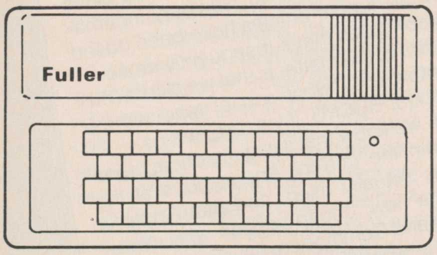

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THE BBC MICRO FILE

It is still very much smaller than the BBC machine in memory capacity, and rather expensive to expand, but the large number of people who have already bought VICs aren't going to throw it away because they have to spend twice as much just to get a disk going. The extra will still be less than switching to a BBC machine.

Short supply

And, of course, the VIC's volume means that people will start making things for it. If you have the two systems in front of you, then the VIC plus the extras needed to make it as nice as the BBC machine may look more expensive. But since the BBC machine is still in short supply, the VIC has a good head start, and will keep it for a few months.

As an example of things that are inherently nicer on the BBCPU, take the BASIC. The VIC uses a slightly enhanced version of PET BASIC, while the BBC has a far more modern version.

When PET BASIC came out, it was one of the nicest things in the world, and it is still nicer than some in many areas – but it did come out four years ago. The result is that the VIC does nice things, like sound and colour – but to use them, you have to be a numbers magician, because they all require exactly the right number to be POKEd into the right memory location, to work.

By contrast, on the BBC machine, if you find that you need to use a funny numbers series you can actually define your own BASIC function. If you need a constant sequence of funny numbers and actions and inputs, you can define your own procedure, with a sensible name.

These things matter. At the moment, if you read through a BBC program, you will find that it is pretty hard to understand because the machine has only 16 Kbytes in its small "A" form, or 32 Kbytes in the larger "B" form, for programs. So, to keep the program compact, programmers use tricks like putting lots of statements on one line, of abbreviating instructions, and of using short names for functions and variables.

This makes somebody else's program impossible to decipher without a lot of hard work.

In five years' time, however, programs will be a very great deal longer than they are today. They will also need fixing a lot, because the longer a program, the more faults it has and the longer it takes to find them.

Structured programming

At that stage, a nice "structured" BASIC program on the BBC machine, or its granddaughter will be relatively easy to unders. "Oh, I see what the programmer has done," you will say. "He's just stored all the intermediate stuff under a file called Intermediate, and uses a routine called Fetch to fetch it into the data area."

With the VIC, you will be reduced to wondering what the deuce POKE 36879,34 actually does to the USR routine which seems to be causing the problem – you think. Then you find it isn't that, anyway, and have to find another theory. Perhaps it's what you do with PEEK (6531) .... no, no, that's the fifth line on the screen, isn't it?

This sort of thing is going to be a very serious problem for professional writers of programs, too. All you have to do to work it out, is get a price quote on a memory chip.

Four years ago, 128 bytes of memory cost a few pounds, and the idea of having enough memory to run even the silly "Tiny" BASIC interpreters that took over 4,000 bytes of space was just a dream. Why, you would need 8,000 bytes before you could run any programs of your own!

So people happily designed systems round chips with a maximum of 65,536 bytes, and the result is that less than half a decade later, we are stuck with memories that take only eight chips, each costing well under £10, and could easily use four, eight or 32 times that amount of memory. And when that memory comes along, it will be used with similar recklessness.

The BBC's way of coping with the fact that in five years' time, even three million characters will be starting to feel cramped (and will only use 24 chips) is the Tube, which allows the BBCPU to serve a more powerful machine as a helpful slave, fetching and carrying messages to screens, disks and printers.

Upgrades

No doubt Commodore will have more than one machine capable of fulfilling that gap, but it won't be the VIC, simply because the VIC's programming language won't stand it. Programs of 32 Kbytes can be as hard as you like to read and adapt, but programs of three megabytes need structure, organisation, and ease of analysis.

Instead, people with VIC machines will buy upgrades – the way people with VICs are doing already. Things like Vickit, which is a board that provides extra memory, extra programming features, and help for the programmer (and dead cheap at £50, too). And people with the BBCPU will be one move ahead.

Similarly, it will be easier (I think) to link BBC machines together, because the beast has been designed around its own Econet logic and software which will do the job. And people with VICs will have to purchase add-ons.

The unknowable question is: will all these add-ons be equally good value – value like Vickit seems to be? Or will they be confusing, cause differences between users, and add to the price of using a VIC?

If the latter, the BBC's care in choosing an expandable system will have been worth while.

That just looks at the conflict between VIC and BBCPU. What about Atari? What about Sinclair's new *Spectrum*? What about the £200 system based on a 16-bit Motorola chip, due out April next year, including colour, a modem, a megabyte of memory, and all in a pocketable case with a ten-hour rechargeable battery, and capable of sending messages to your big disks at the office via the mains?

No, I don't know anybody doing that, but I bet somebody is. And if you want to know how the BBCPU fits into that kind of future, write your own article, because frankly, your guess as to how it will go is as good as mine.

Econet

My guess, since you insist, is that the BBC's main significance will turn out to be the fact that it got Britain's second most promising microcomputer builder past the very difficult phase of being a small, well-managed partnership between Chris Curry and Hermann Hauser, into the properly-financed, corporately structured (and hopefully, also well-managed) rival to America's and Japan's micro corporations.

I also think that the Econet is going to turn out more important to the design of micros in Britain (and anywhere else that the BBCPU sells) than anything else about the machine. That is despite the fact that I've already seen a 32-bit micro running happily on the othe end of the Tube, using BBC colour an graphics, in prototype form – something yo won't find any stand-alone systems doin even based on Motorola 68000 chips or Inte 8086 chips.

And lastly, I think you shouldn't believ anything like half the strange stories you a going to hear about fights between the BB and Acorn. But I do think you will hear a l And, naturally, if I hear any good ones, pass them on....

MONEY MANAGEME

Tim Hartnell develops two useful home utility programs to help you manage

This month we have a couple of financial utility programs for the ZX81 which will prove of interest if you ever have any money. They are simple in their present form, and can easily be tailored to your individual needs.

Home Accounts:

In its present form, the HOME ACCOUNTS program allows you to manipulate six variables, as well as the balance (B). The variables, which are all elements of the array M, are:

1 – cheques out
2 – credit cards
3 – rates
4 – mortgage
5 – standing orders
6 – monies in

You can easily modify the program to cater for more elements, by changing the value of M in line 40 to the number of elements you want to have in array A, and by adding subroutines to cater for them.

Lines 180 and 280 take the place of the ON...GOSUB command found in many BASICs. What it does, in this program, is GOSUB the line number held within the brackets with the value of F. That is, if F equals 4, the program will GOSUB 360, because the particular bracketed expression is (360 AND F = 4). You can use this idea in any program where you need an ON...GOTO or an ON...GOSUB.

'MONIES IN' is always shown as a negative number, but you can fairly easily change it so the display of this array element value is shown as a positive number like the others.

The program explains itself as it runs. To save the balance from an earlier run, use GOTO 70, rather than RUN to get the program underway. If you SAVE the program on tape *after* running it, the balance will be SAVEd, along with the program. The sample run should make the operation of the program clear.

Cheque Book:

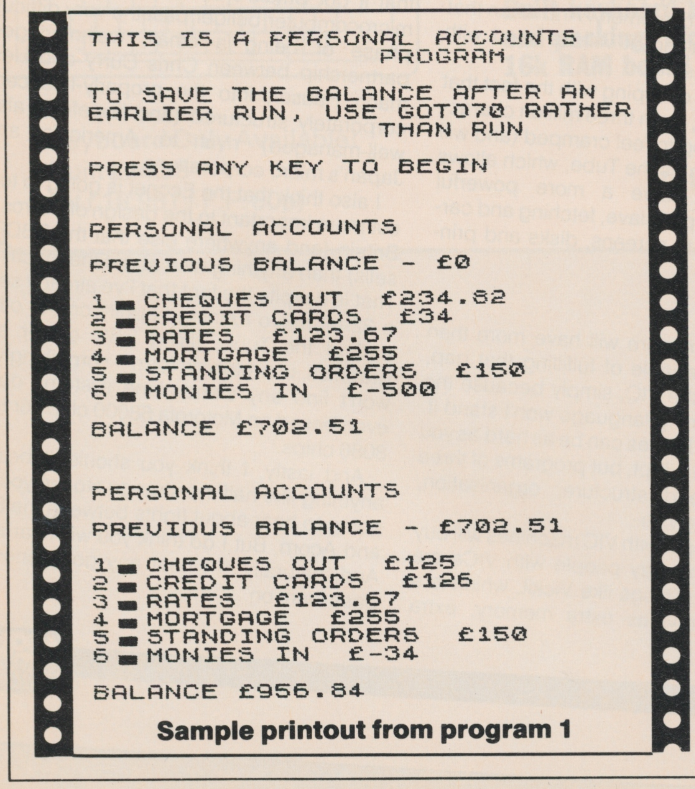
The second program offers you four choices when you first run the program:

1. CHEQUES WRITTEN which allows you to enter details of cheques from your stubbs
2. DEPOSIT MADE – which enables you to do the same thing with money in.
3. COPY TO PRINTER – which, of course, dumps the screen contents to the ZX printer.
4. END PROGRAM – for a graceful exit.

Choices one and two of the menu allow you to enter any number of amounts, one by one (each followed by NEWLINE), then the letter 'E' to return to the main program.

Although the input routines at lines 1060 and 2070 are numerical, rather than for strings, the 'E' is accepted, because E has been assigned (to RND) in line 25.

If you wish to keep the final balance from run to run, SAVE the program after using it, then enter GOTO 52 instead of RUN.



```
THIS IS A PERSONAL ACCOUNTS
                PROGRAM

TO SAVE THE BALANCE AFTER AN
EARLIER RUN, USE GOTO70 RATHER
                THAN RUN

PRESS ANY KEY TO BEGIN


PERSONAL ACCOUNTS

PREVIOUS BALANCE - £0

1 ▀ CHEQUES OUT  £234.82
2 ▀ CREDIT CARDS  £34
3 ▀ RATES  £123.67
4 ▀ MORTGAGE  £255
5 ▀ STANDING ORDERS  £150
6 ▀ MONIES IN  £-500

BALANCE £702.51

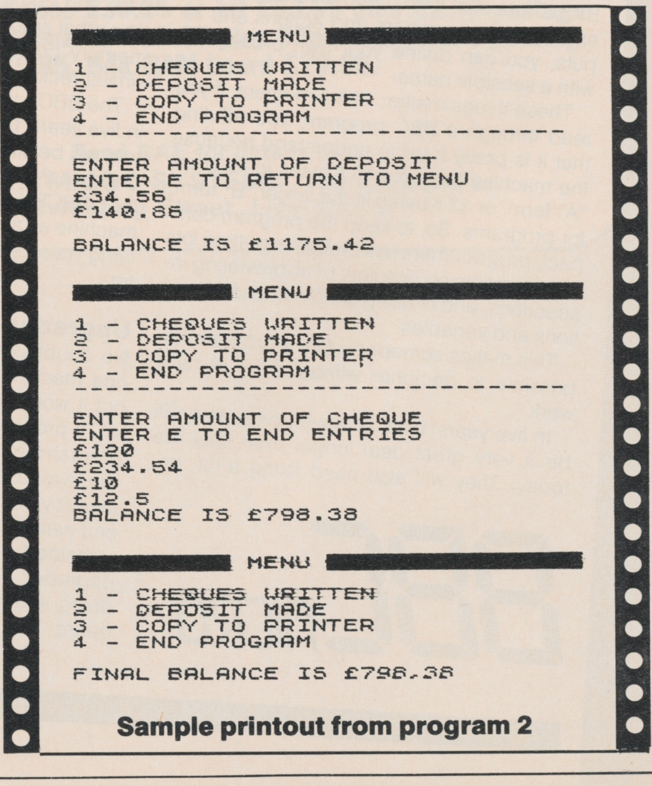

PERSONAL ACCOUNTS

PREVIOUS BALANCE - £702.51

1 ▀ CHEQUES OUT  £125
2 ▀ CREDIT CARDS  £126
3 ▀ RATES  £123.67
4 ▀ MORTGAGE  £255
5 ▀ STANDING ORDERS  £150
6 ▀ MONIES IN  £-34

BALANCE £956.84
```

Sample printout from program 1



```
██████████ MENU ██████████████
1 - CHEQUES WRITTEN
2 - DEPOSIT MADE
3 - COPY TO PRINTER
4 - END PROGRAM
--------------------------------

ENTER AMOUNT OF DEPOSIT
ENTER E TO RETURN TO MENU
£34.56
£140.86

BALANCE IS £1175.42

██████████ MENU ██████████████
1 - CHEQUES WRITTEN
2 - DEPOSIT MADE
3 - COPY TO PRINTER
4 - END PROGRAM
--------------------------------

ENTER AMOUNT OF CHEQUE
ENTER E TO END ENTRIES
£120
£234.54
£10
£12.5
BALANCE IS £798.38

██████████ MENU ██████████████
1 - CHEQUES WRITTEN
2 - DEPOSIT MADE
3 - COPY TO PRINTER
4 - END PROGRAM

FINAL BALANCE IS £798.38
```

Sample printout from program 2

ENT

nage your finances.

```
  10 REM CHEQUE BOOK
  20 REM (C) HARTNELL 1982
  25 LET E=RND
  30 SCROLL
  40 PRINT "ENTER BALANCE"
  50 INPUT BAL
  52 SCROLL
  56 PRINT "BALANCE IS £";BAL
  60 SCROLL
  65 SCROLL
  66 SCROLL
  70 PRINT "████████ MENU ████
████████"
  75 SCROLL
  80 SCROLL
  90 PRINT "1 - CHEQUES WRITTEN"
 100 SCROLL
 110 PRINT "2 - DEPOSIT MADE"
 120 SCROLL
 130 PRINT "3 - COPY TO PRINTER"
 140 SCROLL
 150 PRINT "4 - END PROGRAM"
 300 INPUT MENU
 310 GOSUB MENU*1000
 320 GOTO 52
1000 SCROLL
1010 PRINT "--------------------
-----------"
1020 SCROLL
1030 SCROLL
1040 PRINT "ENTER AMOUNT OF CHEQ
UE"
1045 SCROLL
1050 PRINT "ENTER E TO END ENTRI
ES"
1060 INPUT CHE
1065 IF CHE=E THEN RETURN
1070 SCROLL
1080 LET BAL=BAL-CHE
1090 PRINT "£";CHE
1100 GOTO 1060
2000 SCROLL
2010 PRINT "--------------------
-----------"
2020 SCROLL
2030 SCROLL
2040 PRINT "ENTER AMOUNT OF DEPO
SIT"
2050 SCROLL
2060 PRINT "ENTER E TO RETURN TO
 MENU"
2065 SCROLL
2070 INPUT DEP
2080 IF DEP=E THEN RETURN
2100 PRINT "£";DEP
2110 LET BAL=BAL+DEP
2130 GOTO 2065
3000 COPY
3010 RETURN
4000 SCROLL
4010 SCROLL
4020 SCROLL
4030 PRINT "FINAL BALANCE IS £";
BAL
4040 STOP
```

Program 2

```
  10 REM HOME ACCOUNTS
  20 REM (C) HARTNELL AND
  30 REM    JONES 1982
  40 LET M=6
  50 DIM A(M)
  60 GOSUB 400
  70 GOSUB 230
  75 PRINT "ANY CHANGES? (Y OR N
)"
  80 INPUT Z$
  90 IF Z$="N" THEN GOTO 200
 100 PRINT "NUMBER?"
 105 INPUT K
 110 IF K<1 OR K>M THEN GOTO 105
 120 PRINT "ENTER AMOUNT"
 130 INPUT E
 140 IF K=6 THEN LET E=-E
 150 LET A(K)=E
 160 GOTO 70
 170 PRINT F;" █ ";
 180 GOSUB (330 AND F=1)+(340 AN
D F=2)+(350 AND F=3)+(360 AND F=
4)+(370 AND F=5)+(380 AND F=6)
 190 PRINT TAB 4;"£";A(F)
 200 PRINT "ENTER SALARY"
 205 INPUT S
 207 GOSUB 230
 210 LET R=S-T+B
 215 PRINT "BALANCE £";R
 220 LET B=R
 225 STOP
 230 LET T=0
 232 CLS
 234 PRINT AT 3,0;"PERSONAL ACCO
UNTS"
 236 PRINT AT 5,0;"PREVIOUS BALA
NCE - £";B
 240 PRINT AT 7,0;
 250 FOR F=1 TO M
 270 PRINT F;" █ ";
 280 GOSUB (330 AND F=1)+(340 AN
D F=2)+(350 AND F=3)+(360 AND F=
4)+(370 AND F=5)+(380 AND F=6)
 290 PRINT "  £";A(F)
 300 LET T=T+A(F)
 310 NEXT F
 315 PRINT
 320 RETURN
 330 PRINT "CHEQUES OUT";
 335 RETURN
 340 PRINT "CREDIT CARDS";
 345 RETURN
 350 PRINT "RATES";
 355 RETURN
 360 PRINT "MORTGAGE";
 365 RETURN
 370 PRINT "STANDING ORDERS";
 375 RETURN
 380 PRINT "MONIES IN";
 385 RETURN
 390 STOP
 400 PRINT
 440 PRINT "THIS IS A PERSONAL A
CCOUNTS"
 445 PRINT ,"PROGRAM"
 447 PRINT
 450 PRINT "TO SAVE THE BALANCE
AFTER AN"
 460 PRINT "EARLIER RUN, USE GOT
070 RATHER"
 470 PRINT ,"THAN RUN"
 480 PRINT
 490 PRINT "PRESS ANY KEY TO BEG
IN"
 500 LET B=0
 510 INPUT A$
 520 CLS
 530 RETURN
```

Program 1

BENCHTEST
COMPUTER SYSTEM

CRAY 1 : BENCHTEST

Rod Peterwell tests one of the latest upmarket machines from the States.

Once installed, the CRAY-1 looks a good deal better designed than most micros, and can make quite an attractive conversation piece.

Introduction

There's a lot of nonsense talked about performance in computers. Is the 4MHz Zilog Z-80A faster than a 2MHz MOS Technology 6502? In theory, yes: in practice, it depends what you're doing with it and whether you can get hold of them in the first place to compare the two.

With that caveat in mind, we approached this benchtest of the Cray 1 with a good deal of healthy scepticism. After all, the advance publicity sounds distinctly dodgy: the PR blurb claimed that until a few months ago the Cray 1 was the fastest computer in the world.

Now Control Data claims that position for its even more unlikely sounding Cyber 205, which the Met Office reckons is "about seven times faster than any other existing machine". The Cyber 205 hits about 400 million arithmetical operations per second; the Cray 1 struggles a bit to do more than 80 million or so per second. Still, as a measure of comparison you might well have one of the ageing IBM 370/168s that were so popular in the early and mid 1970s: the Cray 1 has computing power equivalent to about fifteen 370/168s.

Hardware

There was a good deal of innocent fun when the Cray arrived for its benchtest, partly because one of the two pantechnicons knocked over four of the saplings that Islington's new SDP council recently planted outside the reviewer's home. Unloading the Cray was also something of a job, with the crane finding manoeuverability a touch tricky. But by taking out an upstairs window and a short section of brickwork we were able to fly the equipment in via the bedroom.

So what do you get for your money? The basic Cray 1 consists of the CPU, power supply, cooling equipment (freon), one or more minicomputers which act as front-end consoles for maintenance and job entry (we used a nifty little Data Eclipse), and two or more disk units.

The CPU isn't as compact as it might be, in our view, and frankly the design doesn't look anywhere near as ergonomic as say the IBM Personal Computer or the Sirius. The CPU cabinet is round, for one thing, and that means it doesn't fit easily into the odd spare corner (unless you live on a lighthouse). It also takes up 70 sq. ft. of floorspace, which isn't bad for a mainframe but which can be a mite awkward in the average first-floor flat. Partly it needs so much space because it stands on a 9ft diameter base. This is a bit irritating for stubbing your toes: but it is attractively padded with vinyl for you to sit on, and it could easily make an interesting conversation piece.

The main part of the column is 4.5ft in diameter and 6.5ft high. It consists of 24 'chassis' organised as upright wedges radiating from the central pillar. It weighs 5.25 tons.

Inside, things look a bit of a mess. There are 1,662 plug-in modules of 113 different types – enough circuitry to equate to 2.5 million transistors – and it's all hard-wired, so there's a lot of spaghetti in there. Still, Cray reckons it's the neatest they could do.

The CPU comprises registers, 12 functional units for parallel processing, and instruction buffers in its 'computation' section. The memory section holds up to four million 64-bit words in bipolar chips (they're a bit faster than the more usual kind of MOS chips – access time about 50 nanoseconds). And there is an I/O section with 12 input and 12 output channels, all of which can be active at the same time. They are quite fast, too: 16-bit data can be transferred along them at 160 million bits per second, for instance, and it's not really worth going faster than that because there isn't very much that you can plug into a computer which works even that quickly.

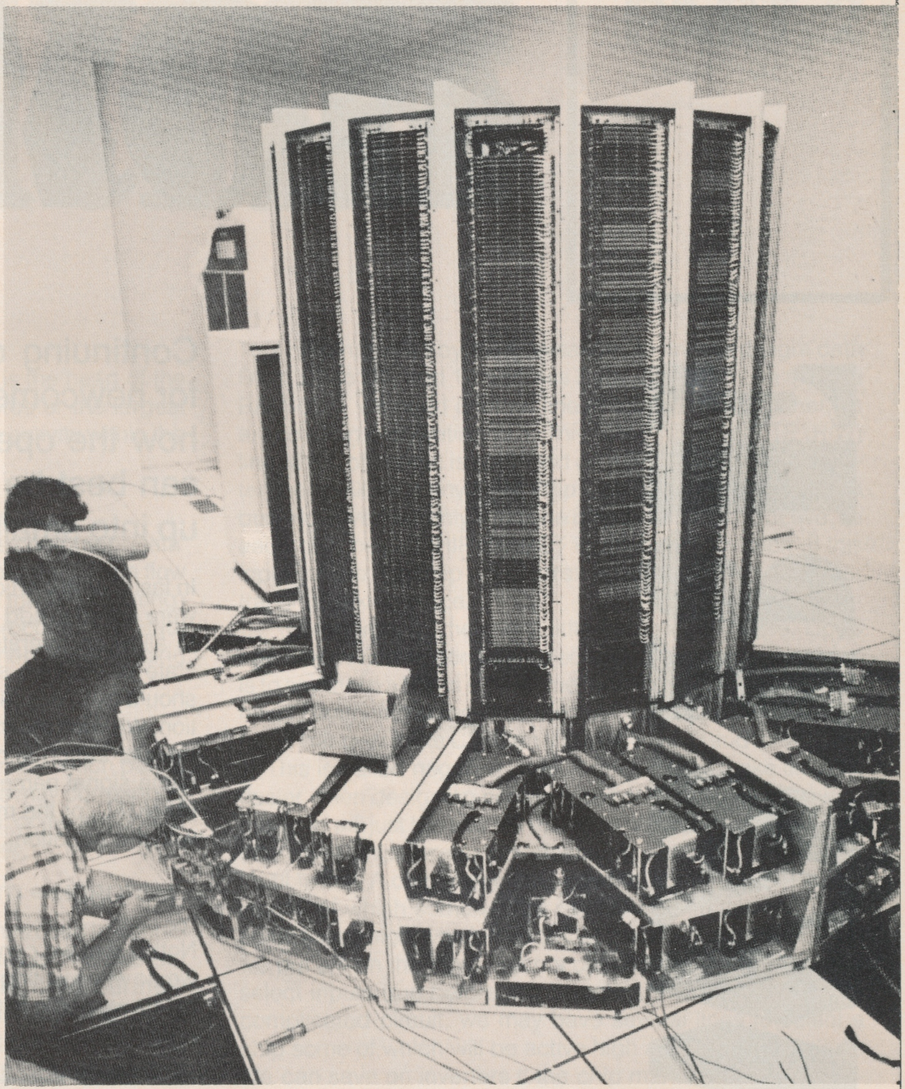
The Cray achieves its speed in four ways: fast circuitry, big memory, vector arithmetic, and parallel processing.

Faster circuitry obviously means faster processing, and the 9MB memory on the Cray 1 certainly cuts out the need for the kind of disk swapping that many computers have to do all the time to run decent-sized programs (they split programs into chunks and bring just a module or two at a time into memory for execution. With 9MB the Cray can fit in most programs without having to divide them into manageable lumps).

The vector arithmetic is pretty neat. In a conventional computer, calculations are performed sequentially – typically with two numbers being sent from registers to the arithmetic processor which responds with a solution. The Cray 1 can do that kind of work in any case, using a set of registers it calls 'scalar' registers. But in addition it can take a set of numbers (a vector) and perform calculations with it on another vector: and while it might not figure too much in your average Space Invaders game or sales analysis program, in scientific and engineering work this vector arithmetic is required with surprising frequency.

To handle it the Cray 1 has special hardware, special registers, and special instructions.

The parallel processing bit happens because inside the CPU there are a dozen independent sub-processors all beavering away simultaneously on address modifications, or scalar, vector, or floating point arithmetic. So up to 12 instructions may be executed at once.



Inside: the wiring looks 'a bit of a mess'; our reviewer found that a soldering iron was 'helpful' when assembling the kit.

Operating System

The Cray Operating System, rather like CP/M, manages the resources, supervises the running jobs, and performs the I/O operations.

Cray says it deliberately kept the operating system "straightforward and uncomplicated" in order to minimise the system overhead. Other people have called it "minimal".

What actually happens is that you set up a job – a program to be executed, say – and enter it at a job entry station (which is typically a minicomputer plugged into an I/O channel). The job sits around on disk until the operating system decides it has the resources available to execute it.

The operating system handles up to 63 multiprogrammed jobs at once, and it's basically a batch processor rather than a real-time transaction-oriented machine. All pretty basic stuff.

Talking of BASIC, one of the notable omissions from the Cray is a decent Microsoft-style BASIC interpreter. In fact you only get two languages, and neither is BASIC – let alone Comal, or Pilot, or Pascal, or even Cobol. No, what Cray in its wisdom has decided you shall have is an assembler plus stodgy old Fortran. At least it has built-in vector management.

There isn't much else available in the way of software. This is one of the perils of not opting for a standard OS; had Cray gone for CP/M, say, or even CP/86, there would have been a pool of high-quality programs instantly available for the computer. As it is, you'll probably have to write your own.

Documentation

The 43 manuals arrived the day before the Cray in a separate truck, so we were able to get stuck into them before the computer arrived. In general they were OK.

Expansion

In the middle-term, the Cray looks quite versatile. Four million words of memory is equivalent to 32 million bytes, and that ought to be enough for anyone. The 12 I/O channels mean you can attach six front-end controllers of various kinds and then hang on disks, terminals, light pens or whatever your heart's content (or to your front-end's capacity).

No problems about the future, either. While Cray's corporate HQ is in charming Mendota Heights, Minnesota, and the software people are in delightful Boulder, Colorado, the de- ▶

With acknowledgements to Personal Computer World, whose Benchtests have been a continuing source of amusement to the trade.

HARDWARE

HOW IT

Continuing our series of explanations for newcomers, Chris Preston shows how the operation of a microcomputer can best be understood by breaking it up into smaller 'black boxes'.

In last month's article, we set a problem in logic design. You were asked to add an extra feature to our piece of equipment to allow an operator to turn the motor on regardless of the state of the time switch. Before writing down a circuit, we should try to describe the logic in words and then in an equation. We want the motor to be on if the time switch is on or the manual switch is on, but not if the door is open. Using the same signal names as last month, but adding the new line MANUAL for the manual switch, we can express the circuit with this equation:

$$\mathrm{MOTORON} = (\mathrm{TIMEON} \vee \mathrm{MANUAL}) \wedge \overline{\mathrm{DOOROPEN}}$$

Notice that we can use brackets to enforce a priority just as we do when writing mathematical expressions in BASIC. Now at last we come to the circuit:

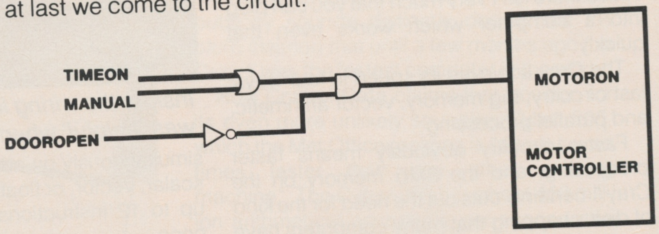


DIAGRAM 1

Hands up all those who got it right? Very good!

Now to this month's business. In the first article in this series, we looked at some of the most basic chips used in computers. This month, we will start with the large black box labelled 'Computer' and break it down into smaller units 'Processors', 'Memory' and so on. These are still black boxes, but smaller ones anyway!

The illustration below is a block diagram of a computer showing the main elements which go to make it up.

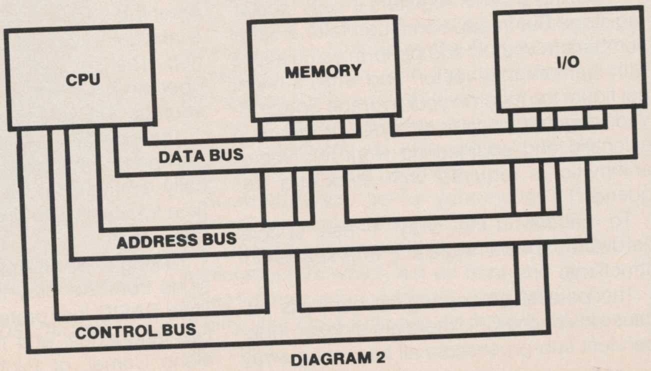


DIAGRAM 2

WORKS

PART 2

CPU

This is the Central Processing Unit which is the heart of the computer. It might be the smallest of micros or the largest mainframe processor and it controls all the activity within the computer through the three buses.

Data Bus

The data bus carries information around the computer. 'Data' in this sense means program as well a proper data. Data flow around the computer is always either from the CPU (writing) or to the CPU (reading). In a simple microcomputer, data cannot flow from one peripheral to another without going through the CPU.

Address Bus

The address bus is used by the CPU to identify which part of the computer it wishes to talk to. An address may correspond to a memory location, or part of the screen, or the keyboard, depending upon the design of the computer.

Control Bus

The control bus consists of a collection of lines used to control the running of the machine. The actual lines in this bus depend very much upon the CPU which is being used, but there are only two which we need to worry about here. The first of these is the READ/WRITE line. This is an output from the CPU and is used to tell a peripheral whether the CPU is going to write some data or expects a byte of data to be sent to it.

The other important control line is RESET. Many complicated chips such as the CPU have a RESET input to put them into a known state. This is always done when the machine is first turned on, because otherwise the conditions of the processor and all its anciliary chips would be completely random when you first turned on, and the chances of being able to do anything useful would be very small indeed!

Memory

Under the heading "memory" we include both Random Access Memory (RAM) used for storing data, and Read-Only Memory (ROM) which is often used for BASIC and the operating system. The memory is connected to the address and data buses, and also one of the lines in the control bus, R/W, which tells the memory whether we are writing to it or reading from it. Here is a typical RAM chip:

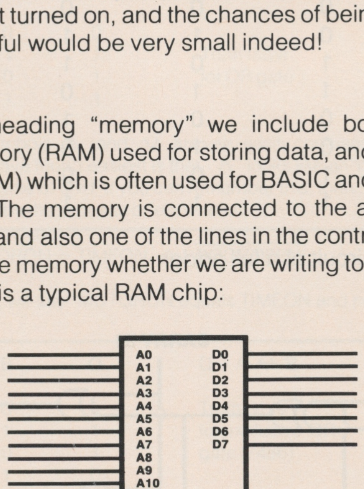


DIAGRAM 3

This chip has a 4 kbyte organisation, so we need eight data lines, D0 to D7, and 12 address lines, A0 to A11. As this is a RAM chip, we need another line to tell the chip whether we are reading it or writing to it. This is the READ/WRITE (R/W) line which of course is not found on a ROM chip. In a computer there will be many RAM chips, all connected to the data bus. However, we only want one chip at a time to be active, so each chip has a CHIP SELECT input, or $\overline{\text{CS}}$ for short. If this input is false, the chip will go to sleep and not affect any other transfers taking place.

Unfortunately, there is a little complication here. Up to now, we have only considered so-called **positive logic,** which is to say that if a line is a 1 it is true, and if a 0 it is false. We now how to learn that some lines are the other way round! If a line has a bar over it like $\overline{\text{CS}}$, then it is true when 0 and false when 1! This is called **negative logic.** It does in fact make life a lot easier when designing certain types of circuit, but at the moment we will just have to put up with it. What it boils down to is that some chips are selected when a particular chip select input is **low.** A chip may in fact have two or three chip select inputs, of which some will be **active low** (like this chip) and some **active high,** which means that the chip will be selected if we put a 1 on the input. Such a chip has to have **all** the chip select inputs true before it is selected. This is because in a complicated circuit, we may have several lines to select a chip some of which will be active high and some active low. We can save on inverters if the chip manufacturer has provided some inputs of each type. Any unused chip select inputs can be wired permanently high or low, depending upon their type.

In last month's article, we saw how a decoder chip can be used to produce 8 select signals from 3 lines on the address bus. Here we see a decoder actually being used in a memory circuit. We have only shown 3 RAM chips – to keep things simple.

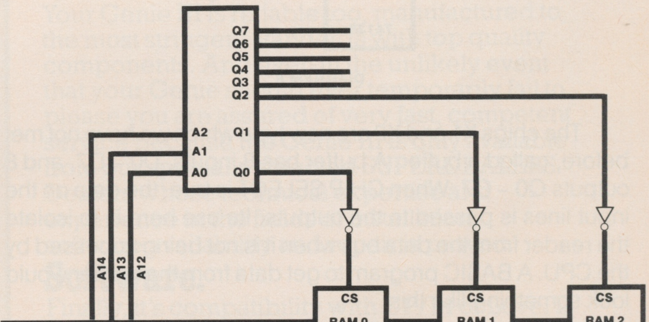


Diagram 4

We can see that the bottom (least significant) twelve lines of the address bus go to each of the RAM chips, and are used to select a particular element in the chip. Which chip re-

▶

HARDWARE – HOW IT WORKS

sponds depends upon A12 – A14, which select one of the eight RAM chips. If the CPU puts out an address $2147, then A12 – A14 form the number 2, which selects chip number 2. The lower 12 bits are used to select location $147 in that chip.

Input/Output

The I/O section comprises all communication between the computer and the outside world. It will consist of a screen and keyboard as a minimum, as well as possibly a printer and disk drive. This is the most difficult section of all to characterise, as there is a tremendous variety of systems in use – more or less one for each machine!

To avoid the accusation of being biased towards any particular machine (heaven forbid!) we will once again look at a proverbial 'hypothetical example'. Just to make it a little different from the normal run-of-the-mill micro, we are going to hang a paper tape reader onto our computer.

This paper tape reader occupies two addresses, $2000 and $2001. $2000 is the address we get data from the reader, and $2001 is a 'status' byte. A paper tape reader is a very slow peripheral (the only slower input device is a keyboard!), so the computer will need to wait for the reader. To help the computer know when its character is ready, the reader produces a 'READY' signal which a programmer can test in the status byte.

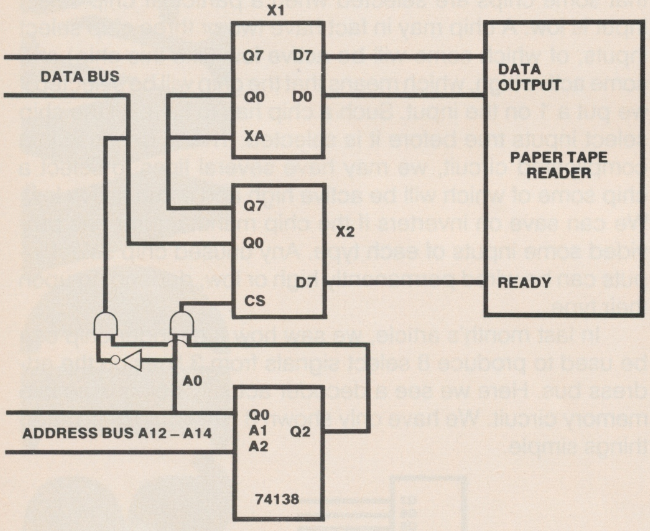


DIAGRAM 5

The chips X1 and X2 are new type which we have not met before, called a buffer. A buffer has 8 inputs, D0 – D7, and 8 outputs Q0 – Q7. When CHIP SELECT is true, the data on the input lines is passed to the outputs. Its use here is to isolate the reader from the data bus when it is not being accessed by the CPU. A BASIC program to get data from the reader would look something like this:

```
100 IF PEEK (8193) = 0 THEN 100
110 PRINT PEEK (8192)
120 GOTO 100
```

CPU

The internals of even the simplest microprocessor are incredibly complex, running to hundreds or even thousands of gates. We shall not even attempt an explanation of how a processor works until next issue, but for the time being we are going to look at quite a simple circuit, built up from gates we covered in the first article, which forms the basis of an arithmetic processor. This is a circuit to perform the addition operation.

Once again, before delving into the circuit, we have to decide what we want it to do. The simplest possible adder will just add two bits together to produce a 1 bit **sum** and a one bit **carry**. Here is the truth table for the addition operation:

A	B	SUM	CARRY
0	0	0	0
0	1	1	0
1	0	1	0
1	1	1	1

If we look at the SUM and CARRY columns, we can see that the SUM is just the exclusive-OR of the two inputs, and CARRY is the AND of the two inputs. We can now design our circuit, which is called a **half-adder.**

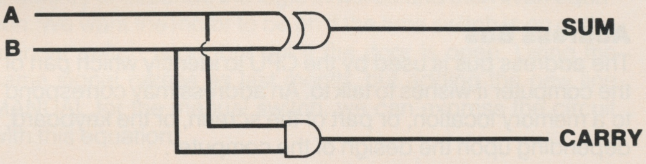


DIAGRAM 6

Of course, in any practical application, we will need to be able to add more than one bit at a time; a typical micro works in 8-bit units. To do this, we need to **cascade** several adders, one for each bit, but this (of course!) introduces an extra complication: each adder now has to accept as an input the carry out from the previous bit. To do this we have to turn our half-adder into a full adder:

A	B	CARRY IN	SUM	CARRY OUT
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

Here is the circuit of a full adder:

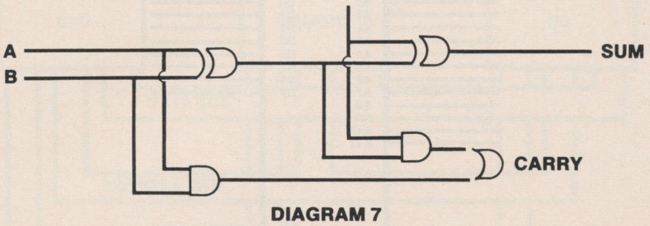


DIAGRAM 7

Now we have a one bit adder, how can we connect them up to make an n-bit adder? Here is a simple system for 3 bits:

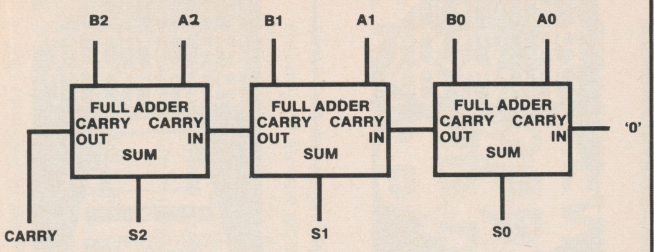


DIAGRAM 8

This is in fact not really a practical system for a computer for two reasons. First – each stage has to wait for the previous one to finish its calculation (even the simplest of gates takes some time to produce an output) a 16-bit adder would be very slow, almost .5 microseconds using standard chips, which is too slow, believe it or not, to be of any use! The second drawback is that the latest adder will produce an output immediately, depending upon its inputs, but this will not necessarily be correct until all the carries have been worked out in the earlier stages. This can result in the various output lines changing state while the circuit is calculating, which can be very confusing to any ciurcuits connecated to those outputs. This leads to the name for this type of adder: a **ripple** adder, because the carry travels through the unit like a ripple on a pond. "It is beyond the purview of my department", as they say in the Civil Service, to go into all the clever ways of improving this simple circuit, but suffice it to say that it is possible to build a 16-bit adder which gives a result in less than .1 microseconds using easily obtainable chips.

Next month we shall be looking at the internal structure of a CPU – and how it can be broken down into simple units, similar to the ones examined above.

Gremlins

Our sincere apologies on behalf of the gremlins concerned to all readers who were confused by the missing symbols in last month's explanations. Corrected versions of the relevant sections of text are reproduced below:-

A	B	Q	$Q = A \wedge B$
0	0	0	
0	1	0	
1	0	0	Truth table
1	1	1	for AND gate

A	B	0	$Q = A \vee B$
0	0	0	
0	1	1	Truth table
1	0	1	for OR gate
1	1	1	

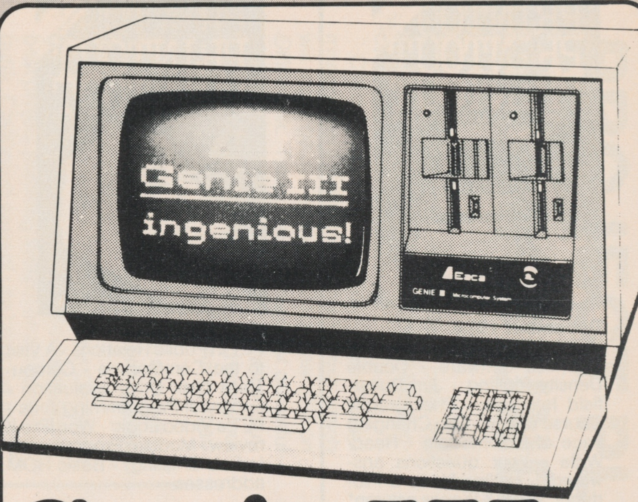
The two symbols $\wedge$ and $\vee$ are very easily confused. The method I have found easiest is that $\wedge$ looks like an 'n', which is the middle of aNd. If you can remember this, then $\vee$ must be OR by the process or elimination.

$$\text{MOTORON} = \text{TIMEON} \wedge \overline{\text{DOOROPEN}}$$

In other words, we say "MOTORON equals TIMEON and not DOOROPEN"

A	B	Q	$Q = A \not\vee B$
0	0	0	Truth table
0	1	1	for exclusive-OR
1	0	1	gate (7486)
1	1	0	

A	B	Q	$Q = \overline{(A \wedge B)}$
0	0	1	
0	1	1	Truth table
1	0	1	for NAND gate
1	1	0	



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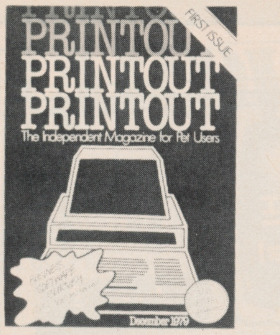
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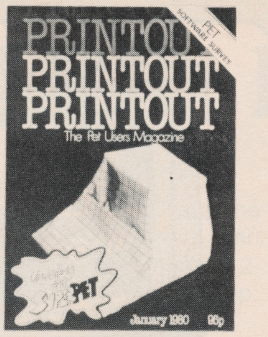
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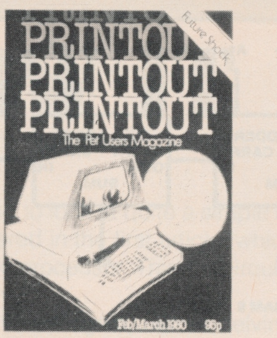
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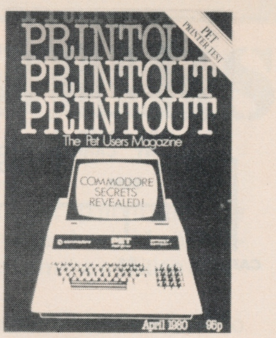
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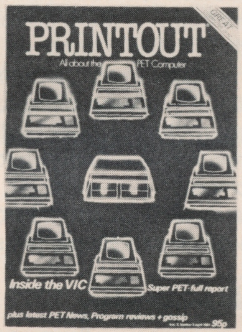
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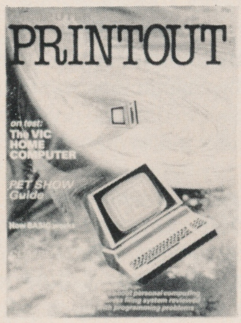
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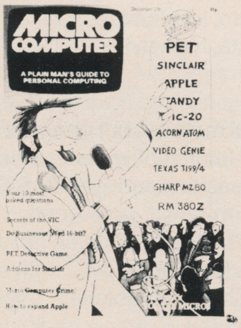
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TOMMY'S TIPS

I am a teeny weeny bit disappointed with you lot. Despite all my pleas, you are still curiously shy about writing to me with your problems. I don't care if you don't sign your letters, I just want to know that I am needed. *Especially* from Apple, BBC, ZX81 etc. owners, and even more especially from you *beginners*. We are no longer a PET-only magazine, so there is no need to be shy about requesting help for other machines. One last request though, when you do write to me, can you tell me exactly what your machine is? I am not psychic!

By the way, please do not write to me asking about obscure add on devices. The Editor pays me so little I can ill afford to buy everything which comes onto the market for each of the machines I use, so questions like "Will XYZ adaptor allow me to connect my TRS-80 to my car and will it really give me a 500% improvement in fuel economy" are really a little bit out of order!

Reaction times

Dear Tommy,
My problem involves timing. I want to be able to time to 1 millisecond rather than 1/60th of a second on my PET keyboard, i.e. record the time taken (in milliseconds) by the person to press the space bar. Do you have any ideas?
L. McIlwraith

Oh yes, I have plenty of ideas, but not all of them are printable! The way to do this is to use one of the large chips inside the PET. This is the 6522, a Versatile Interface Adapator, or VIA for short, which is used for timing, cassette and IEEE operations, the User Port, and many other things besides! One of its many features is a pair of timers, one of which is not used by the PET normally. The way the timer works is that you load in a value representing the time delay you want, and the chip decrements this value every microsecond (under control of the crystal clock which ultimately drives everything in the PET). When the value reaches zero, a bit is set in another register in the chip, which we can test for.

Here is a BASIC program to do the timing, and the corresponding assembly listing. I have put the assembler program in the ubiquitous cassette buffer, but the program is completely position independent, so you can move it anywhere you like, provided that it is safe.

```
033A A900      LDA #00
033C 85B7      STA B7
033E 85B8      STA B8
0340 A597      LDA 97
0342 C9FF      CMP #FF
0344 D0FA      BNE 0340
0346 A9E8      LDA #E8
0348 8D48E8    STA E848
034B A903      LDA #03
034D 8D49E8    STA E849
0350 A597      LDA 97
0352 C9FF      CMP #FF
0354 D00F      BNE 0365
0356 AD4DE8    LDA E84D
0359 2920      AND #20
035B F0F3      BEQ 0350
035D E6B7      INC B7
035F D0E5      BNE 0346
0361 E6B8      INC B8
0363 D0E1      BNE 0346
0365 60        RTS
```

```
50 FORI=826TO869:READA:POKEI,A:NEXT
100 FORI=1TO2000*RND(1):NEXT
200 PRINT"JPRESS"
300 SYS826
400 PRINTPEEK(183)+PEEK(184)*256
500 GOTO100
1000 FORI=24576TO24626:PRINTPEEK(I);:NEXT
10000 DATA169,0,133,183,133,184,165,151,201,255,208,250,169,232,141,72
10010 DATA232,169,3,141,73,232,165,151,201,255,208,15,173,77,232
10020 DATA41,32,240,243,230,183,208,229,230,184,208,225,96
```

How does it work? Well, we first of all clear two counter bytes, $B7-8, giving us a time limit of just over a minute, and not even my reactions are that slow! Location $97 contains $FF if no key is being pressed, and some other value whenever you press a key. The next three lines just check that no key is pressed to prevent cheating. Next we set up the value that the timer is going to decrement to give us a basic time interval of 1 ms. Then, at 350, we start looking for a key to be pressed. If one is being pressed, we jump off to 365, which returns us to our BASIC program. The test at location 359 is to see whether the timer has reached zero. If it has, we increment the counter bytes, and jump back to 346, which sets up the timer again then carries on testing the keyboard image. This program is not 100% accurate, because of the time spent executing the normal PET interrupt routine, which sets up the bytes in $97, but for game purposes it should be perfectly satisfactory.

Finding the name

Dear Tommy,
I have written an assembler routine which is called by the format of SYS30208, "PROGRAM NAME". I find the address of this string by manipulating the test pointers. What I should like to do is to use the format SYS30208,A$, but I do not know how to evaluate a variable string. Can you help?
I. Hamilton

There are two ways of doing this. The first is by looking at the variable table directly. The start of the table is given by the pointer in $2A,$2B and the end of the table in $2C,$2D. Each entry in the table is 7 bytes long, and the format for a string variable is as follows:

Byte No.	Contents
1	ASCII code of first character
2	Second character + 128 (or 128 if only one character in name.)
3	String Length
4	Address of string data, low byte
5	Address of string data, high byte
6,7	Unused.

A more complex and powerful method, but one which is at risk of being messed around by future software releases is to treat the operand as an expression, and get BASIC to evaluate it for you. This means you can say SYS30208,AC$(X+14)+MID$(PU$,X*3,15) if such is your desire! Here is the program for BASIC 4, with the corresponding addresses for BASIC 2 in brackets:

```
        JSR   $BD98   ($CC9F)
        JSR   $C7B5   ($D580)
        CPY     #0
        BNE     J1


        JSR   $CFC9
        JSR   $C7B5   ($D580)
J1      STA     $21
        RTS
```

This routine leaves the length of the string in $21 and a pointer to the string in $1F. By the way, there is quite a common trap involved in playing with strings, and that is that their addresses can change, if garbage collection is used. If you look up the address of a string, and store it, you should remember that the string itself may move. This is especially true in the second method, because this produces a temporary string which in fact is garbage, and might disappear if you go back into BASIC. You should use this string at once, say by copying it into a buffer in your program where it will be safe from the dreaded BASIC.

Big boys!

Dear Tommy,

The trend in new computers seems to be to have more and more memory – even up to 256K. What is the use of this; surely most business programs do not need more than about 20K anyway?

Also, how is it that an 8-bit chip can address so much memory. I thought 64K is the limit?

G. Jones

Who says most business programs only need 20K? What about word processing? VisiCalc? The more memory a machine has, the more information can be held in memory (fast access) rather than on disk (slow access). Apart from the obvious example of a word processor where as much of the document being edited as possible needs to be held in memory, most complicated business systems involve some sort of database, that is a linked system of files, even though it may be called a Sales Ledger or Stock Control. The speed of access of a large file depends upon how much index information can be held in main memory. You can search an index much more rapidly if it is in RAM than if it has to be on disk because it is too large to store in memory. Also, many of the new machines use high resolution graphics, and a complex high resolution display, especially if it involves animation, can eat up huge amounts of memory. A high resolution screen of say 800 points by 400, occupies 40000 bytes, or the total memory of 40 ZX81s!

Uncommon language

Dear Tommy,

Can you tell me anything about APL and who uses it?

A.P. Edwards

APL stands for A Programming Language (I'm not joking). It was developed by a chap called Iverson in the early 1960s as a very high level descriptive tool for computers and data structures, and it was not until some time afterwards that it was actually implemented on a computer and used for software writing. It is a very high level language, extremely artificial and using a very special character set. It is possible to write programs using very few instructions indeed. There is quite a common demonstration comparing a program written in FORTRAN, BASIC and APL. The FORTRAN and BASIC programs are about 30 lines long, the APL about 3 lines! One of the quirks of the language is that there is no operator hierachy, expressions being evaluated from right to left, so that 6*3+4 is 42! APL is rich in operators to manipulate data structures, such as arrays (and rows and columns of arrays), and to allow whole subroutines to be encoded as single statements. APL is not much used on micros, because it requires a large amount of memory to run, as well as being rather tricky to learn.

Nothing can go wrong...

Dear Tommy,

I re14p#?=5'85"5plbout 'checksums', which are used to see if any characters have been distorted after writing to or reading from a disk. What "cpg"vjg{"clf"jmu"fm"they work?

V. Yateley

Error detection and corqf'wjlm#jp##b##ebp'inating subject which can take a large amount of maths and computing power. Anyone who sees the pictures sent back from Saturn and other out of the way places such as Birmingham will appreciate the things that can be done in this field.

On a more simple level though there are several systems of error detection which are in common use. One thing that all these systems have in common is the principle of redundancy, that is sending *extra* data which is not itself significant (that is it does not carry information), but allows us to detect, and possibly correct, errors in the data we are sending or receiving. The first and simplest system is parity, where one bit in each character has an extra bit added so that the total number of 1's in the byte is an odd number (odd parity) or even number (even parity). This is not much use on a disk, because you really want to use all eight bits in each byte for data – parity is too wasteful. So we come to various 'longitudinal' checks. The simplest of these is a simple hash total, where we just add each byte together as it comes in, ignoring carry, to produce a two byte total. This operation is in fact an Exclusive-OR operation of all the bits in the data stream, and is a simple kind of 'Longitudinal Redundancy Check', LRC. The type of checksum commonly used in disk and tape systems is called a Cyclic Redundancy Check, CRC. Here the two CRC bytes are calculated from the data using a certain algebraic equation called a polynomial. This is now normally done in hardware, using one of the special CRC chips such as MC8503.

However it is calculated, the checksum is written to the disk at the end of the data. When the sector is read back from the disk, the checksum is recalculated and compared with the checksum written to the disk. Again this comparison can be carried out by the hardware.

Stereo PET

Dear Tommy,

I would like to use my PET (3016) with my stereo system as a sound to light unit. Can you give me some tips (possibly also on programming) on how this can be done (what A/D and D/A converters are needed, how to separate the sound etc.) Does anyone know of a PET version of the excellent "Phoenix" arcade game?

G. Greene

Using a PET as the centre of a sound to light unit sounds like a fascinating project to me! You will need a fairly good hardware ability to do it though. Are you sure you would not rather build a system from one of the electronics mags?

The sound to light system is a device for flashing several banks of lights depending on the volume of different frequencies in an audio signal. What we have to do is to take an audio signal, split it into several components, measure their amplitudes, and pass the information in digital form into the PET. The PET can then compare the amplitudes with a set of threshold values, and decide which lights to turn on and which to turn off. The conversion from analogue to digital form can be carried out by an analogue to digital conversion chip (ADC). It is possible to buy a complete board intended for the Acorn computer, which has eight analogue inputs. These could be conveniently fed by eight signals derived from eight filters, spaced at

▷ 90

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WHICH BUSINESS SYSTEM?

This is the third in our series of record-cards giving the low-down on several popular computer models. This month we look at three more typical installations.

We stress, as before, that if you are considering purchasing your first microcomputer system, it is very important to study the software first. Make sure that there is a package available that will provide the functions you require, and is operated in a fashion you can understand. Secondly, you should check up on your supplier – can he provide satisfactory after-sales support both in the form of hardware servicing, and software advice over the telephone.

Nevertheless, we feel that it is very useful to have a good idea of the pros, cons and background to most of the popular hardware on the market. Not only in case you still end up with a choice of machines, but also to help you decide on which vendors to try out first.

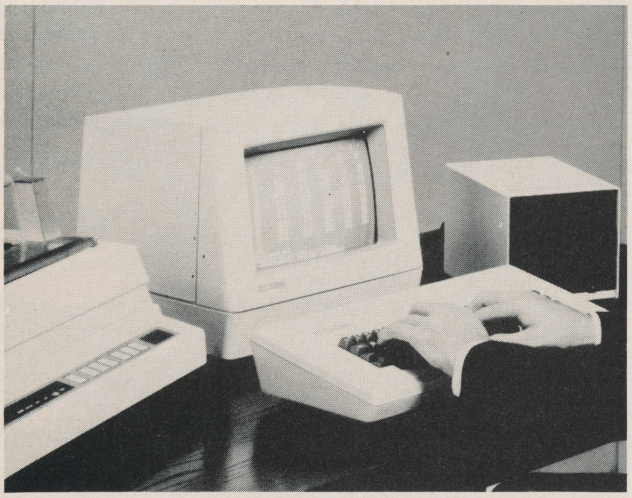
These handy system record cards are designed to help you check out what the hardware salesman tell you – and make your system choice from an informed position.

Listed on each card you will see some brief specifications and an approximate retail price. This includes keyboard, screen, disks and any requisite interfaces – but not a printer. Though several of the suppliers recommended the manufacturer's unit to go with a system, we found that each could operate a wide range of branded printers, though sometimes an additional interface costing £100 or so was needed.

The price also included operating system software, and in some cases, more than one programming language. You should allow extra for applications packages, however.

You will also find sections for Advantages, Disadvantages and our Comments – perhaps the most useful data of all. In a couple of sentences we have tried to sum up what we know of each machine, based on inside industry knowledge, reader's letters and our own technical evaluations.

Finally, there is a typical user. This should not be taken as the only type of user, but rather as an example application which makes best use of the machine's features.



XEROX 820

PROCESSOR: Z-80
RAM: 64K
SCREEN: 80 x 24
KEYBOARD: Separate unit. Numeric keypad. Sculpted like a typewriter.
LANGUAGE/O.S.: CP/M
DISK CAPACITY: 180K
PRICE: £1795 + VAT

ADVANTAGES: Much of the 820's advantages are associated with the name of Xerox. Good after- sales support and service. Quality keyboard and screen based on Xerox's experience with business systems. Good range of off-the-shelf business programs.

DISADVANTAGES: Very low disk capacity (even the twin 8" disk yields only 600K). Not yet very widely available.

COMMENTS: Known internally as the Worm, the 820 is Xerox's attempt to get in on the microcomputer action by 'eating Apple'. It will be sold through the Xerox business stores, microcomputer dealers and direct by Xerox's renowned sales force.

TYPICAL USER: The 820 would appeal to the larger company which requires fairly standard business applications, but requires a high standard of software support and service.

TRIUMPH ADLER ALPHATRONIC

PROCESSOR:	Z-80
RAM:	64K
SCREEN:	80 x 24
KEYBOARD:	Numeric keypad and programmable function keys built into main keyboard.
LANGUAGE/O.S.:	CP/M
DISK CAPACITY:	720K
PRICE:	£2095

ADVANTAGES: Integrated design with one specification. Good reputation for robustness and reliability. Good screen clarity. Several word processing packages take advantage of the programmable function keys (for a change).

DISADVANTAGES: Reset key adjacent to the keyboard. Many of the software packages are written for the non-standard version of CP/M used on the earlier 48K version.

COMMENTS: Triumph-Adler, who are very big in business systems in West Germany are now attempting to take the U.K. market. In addition to the new 64K model, there is the 48K version. Double capacity disks are due to be announced shortly.

TYPICAL USER: Small business (Triumph-Adler are aiming to sell at current users of their typewriters) requiring word processing or traditional transaction processing.

SORCERER COMPUTER

EXIDY SORCEROR

PROCESSOR:	Z-80
RAM:	48K
SCREEN:	64 x 30
KEYBOARD:	Numeric keypad. All 256 graphics can be accessed from keyboard.
LANGUAGE/O.S.:	CP/M
DISK CAPACITY:	1.2MB
PRICE:	£3000

ADVANTAGES: The new combined twin disk offers high disk capacity with excellent screen size and clarity. User-definable character set (accessible from keyboard) would be useful for scientific applications. If the ROM pack feature is not required, then RAM can be extended to 56K.

DISADVANTAGES: Rather poor quality casing by current standards. Little software which makes full use of machine features. Expensive hardware – though cheaper versions available if you don't want the disk capacity or built-in screen.

COMMENTS: One of the first machines to make use of the Z-80, the Sorceror was expected to make a bigger impact on the market than it did. The use of plug-in ROM packs gave Sorceror a 'game machine' image, though very little ROM-based software was ever made available in this country.

TYPICAL USER: An excellent version of SPELLBINDER makes this machine very popular for Word Processing. The main distributors (EMG) sell rather more specialist applications than off-the-shelf packages.

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Everyone's talking about home computers but few have seen them yet. The new Atari 800 & 400 computers and Commodores Vic 20 are now on show at Microchips.

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BEYOND THE FRINGE

Steve Connor meets the wild men of Microcomputing.

More and more micros are sold each year – making a few people very rich and a few more moderately wealthy. The coming year is unlikely to be an exception.

But all those affluent entrepreneurs we know and love, and that includes Clive Sinclair, should take heed. It is written that their days are numbered.

The great American prophet, Charlie Lecht, founder of Advanced Computer Techniques and acclaimed guru, has had a vision. He has returned from the computer industry's mountaintop with a whole new set of rules which could spell disaster for the micro-technocrats and their burgeoning bank accounts.

He reckons that microcomputers are just a passing phase. They are the latest fad, like skateboards five years ago and roller skates today. But although the machines themselves will soon be relics of the past, the interest they have generated in computing will live on.

His rationale is based on one of the most intriguing facets of computer technology: hardware is getting more powerful per dollar, but there is a limit as to how cheap it can become.

So why even try to keep up when you know that next week there will be something better coming along?

In the gospel according to Lecht there will be an alternative source of processing power. You won't find it in a shop window, or even in the pages of *MicroComputer Printout*.

It will be in the shape of a socket in the wall of your living room.

'Of course he's flying a kite,' says Chris Buckham, Marketing Director of ACT, the company which now brings you the 16 bit Sirius 1.

'He's practising futurology. Yes, there will always be a place for the large computer but it doesn't mean to say that everything will be centralised. The micro certainly isn't a passing phase; there will always be a need to have something to form a dialogue with large machines.'

Buckham does not get carried away with the euphoria associated with the future of technology, and, predictably for someone in his line of business, he feels microcomputers, and presumably his job as a micro salesman, are here to stay.

But to get back to Lecht – who is second on the left after Cloud 9 – maybe there is something in his theory after all.

Another guru, Roger Shank from the University of Yale and doyen of Artificial Intelligence, believes it is the aim of mankind to mimic themselves. And one way of trying to do this is by building a bigger and more powerful computer than the last attempt until you have finally managed to build yourself a machine which, to all intents and purposes, performs the same functions as the human brain.

Once you have this monster it can be plugged into every home in the country – rather like water and electricity. What you then have is the processing ability of a genius waiting to be switched on just like an electric toaster.

And that is that as far as the microcomputer is concerned.

But Uncle Clive's bank manager need not worry. If it does happen, and Shank's colleagues are skeptical to say the least, it won't be for a very long time.

(Clive himself isn't worried either, as chairman of Mensa, the club of people with high IQs, he is already plugged into a cranium full of intellect!)

According to Paul Kriwaczek, producer of the BBC series boringly called 'The Computer Programme', Shank's theory is never going to happen – not completely anyway.

'I don't think you can ever have a device which completely analyses itself. So the human brain will never be able to build a replica because that means it must be able to analyse itself to find out how to do it,' he explains.

Kriwaczek is just what you would expect of a BBC producer – cravat, pipe smoking, slighly Bohemian but *very* cultured.

He does not care much for businessmen. When Sinclair was bleating about not winning the BBC microcomputer contract and how unfair it all was, Kriwaczek said that as far as he was concerned his programmes were for the benefit of the viewers and not micro manufacturers.

In the tenth and final programme in the series he attempts to go beyond his brief of explaining what computers are all about. And in it he weaves his own personal, slightly apocalyptical view of where it is all taking us.

'It is just about possible we will build a society where computers become the indispensable slaves. But history has shown that powerful slaves become the most dangerous enemies of all.

'If computers become indispensable servants in a new society, then they will ultimately become the masters,' he adds without elaboration.

That socket in the wall will never seem the same again.

It might even be worth putting up with all those micro entrepreneurs like Sinclair and Derek Rowe. Now Derek is quite an interesting chap, he looks like what you should look like when at college. But unlike most students he has stacks of money.

Has he made this out of micros?

'How I make my money is my own affair,' he says. But come on Derek, we would all like to know about that Rolls Royce you drive around in.

'Oh that was the result of my digital telephone for cars,' he explains. Apparently his 'micro stunt box' which allows the user to do things that could not be done before, is not the real cause of his fortune. It is really his digital telephone for cars 'which was first on the market and far cheaper than anything British Telecom can offer.'

But what about next year? Will his micro business overtake his other interests as far as the green and blue notes are concerned?

'Dunno,' he answers with the deft subtlety of a brick wall.

Even though Rowe is shy about where he gets his money from he is quite happy to admit that when he worked for Commodore his main ambition was to make as much money as fast as possible.

He credits himself with the scheme Commodore now has of charging a small

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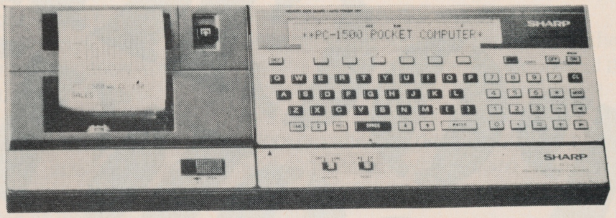

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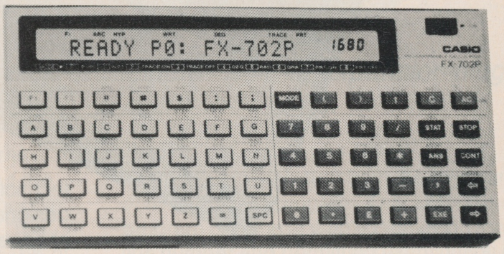

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POCKET POWER

Richard Pawson examines a pocket computer that could put many desktop m ps to

**PC-1500 POCKET COMPUTER*
MEMORY SAFE GUARD / AUTO POWER OFF
DEG
RUN
DEF
SPACE
RCL
SML
OFF ON
REMOTE
PRINT
OPEN
200K
150K
100K
50K
1 2 3 4 5
PC-1500 AND CE-150
SALES (1982)

The pocket computer was invented in 1971. Unfortunately for the credit rating of its inventor, the necessary technology didn't exist at the time.

In the decade that followed the size, cost, power consumption of the sophisticated electronics we call a computer, all shrank.

Ironically, the newest and most sophisticated pocket computer you can buy – the Sharp PC-1500, contains so many original features, that traditional desktop microcomputer manufacturers ought to be paying close attention (they are not, of course, but that's another story).

In some ways, this machine is everything that the microcomputer should have been – it is user friendly, and its design allows the user to reap the maximum benefit from the technology. And most important, it has been designed to do a *new* job; not just an old job cheaper.

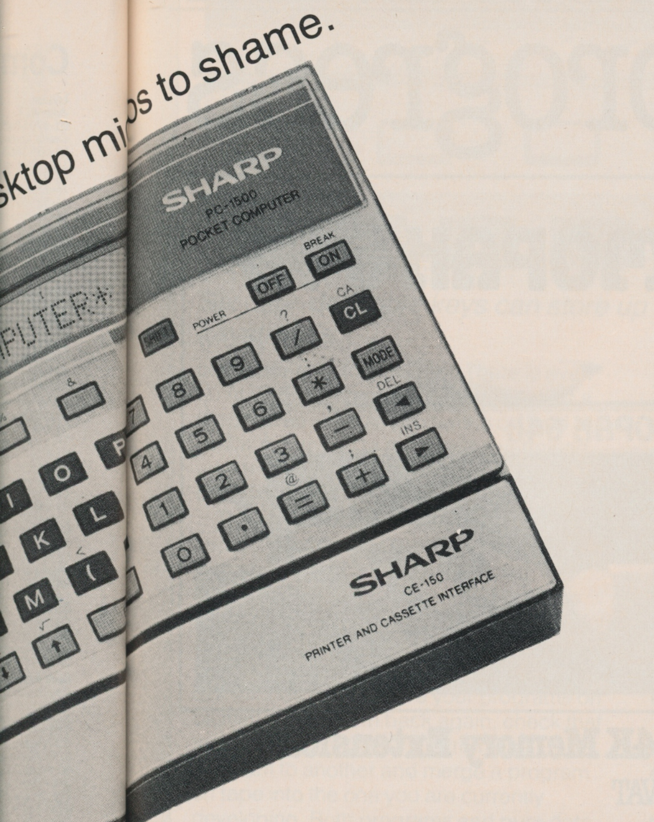
But that is jumping the gun. If hard pressed we will admit to having been more than a little sceptical about pocket computers in general, and the Sharp in particular. Having observed the rise and fall of the programmable calculator at close quarters – they became so sophisticated that only boffins could use them – we expected the PC1500 to prove equally unfriendly. The Publisher (who is a bit that way inclined himself) denounced it as an executive gimmick, and a possible health hazzard to boot.

At a starting price of £170 plus VAT it clearly wasn't going to compete with the colour/graphics/sound capabilities of purpose designed home computers.

On the other hand, the specification looked interesting: fully QWERTY keyboard, programmable function keys, 3.5K RAM, and full BASIC. And as for that 4 colour printer/plotter with cassette interface, that sounded too good to be true. So let's start with a look at what you get for your money.

The Sharp PC1500 is a self-contained computer which measures around 8"x3½"x1", i.e. pocketable if you happen to be wearing dungarees, but otherwise *portable* in your executive briefcase, sporran, or what the continentals euphemistically refer to as 'man-bags'. Four penlight batteries provide power for around 50 hours of actual usage – the computer has an automatic cut-off feature if no keys are pressed for a certain length of time. Thanks to the use of CMOS circuitry the contents of memory – both programs and data – are retained even when switched "off" and there is hardly any battery drain. These cells can also power various peripherals such as the printer/cassette interface, though the consumption is so much greater that regular use of the external mains transformer, supplied with the latter, is to be recommended.

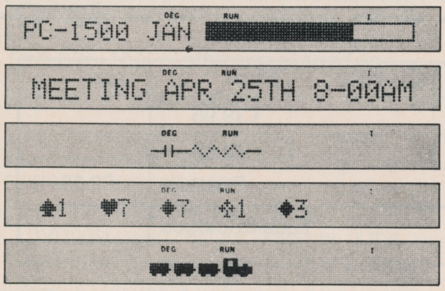
The liquid crystal display (LCD) is a single line of 26 character spaces, with a number of smaller words and symbols above it to indicate the various modes in which the computer can be run. The full range of ASCII characters, including both upper and lower case (which some desktop computers still can't handle) can be displayed on the matrix of 6x7 dots for each field. Clarity is superb and the display does not suffer from the slow response time that characterised early LCDs: the fast-moving cursor leaves



no perceptible ghost image trailing behind it. Furthermore, each of the seven dots in the 156 possible columns can be individually turned on – or off – making possible useful graphic displays as well as somewhat elementary animation for games.

The keyboard contains both a standard QWERTY layout and a separate numeric/arithmetic keypad. There are a number of editing keys and mode functions peculiar to this machine, and the top row of keys are user-definable – a clever feature, of which more anon. Though the keys are necessarily small, they are better-spaced than most calculators, so reasonably fast one-fingered typing is possible without the annoyance of continually hitting several buttons at once.

Though a computer in its own right, the PC1500 is considerably enhanced by the CE-150 printer and cassette interface which we would rate good value at £150, and a 4K plug-in expansion RAM at £50. The way in which the various units plug together looks particularly well-designed compared with the fragile edge connectors employed in most desktop micros. Clearly, Sharp intend to capitalise on the expandability of the 1500. Indeed, they have just announced with some pride a touch sensitive softboard with 140 user-definable keys, complete with transparent overlays for your own designations.



The 26 character display can produce both text and graphics.

As it is likely that the majority of PC1500 users will want to make use of this expansion, we evaluated the PC1500/CE-150 as a system.

One of the most impressive aspects is the extent to which Sharp appear to have anticipated everything one might need: soft carrying case, keyboard overlays, self-adhesive name lable for identification, and for once, you do get batteries in the box. The printer comes in a sturdy carrying case, with sufficient space for the mains transformer, cassette leads, spare pens and rolls of paper supplied.

The documentation, too, is well thought out – a considerable improvement on the translated Japanese instruction sheets sent out with many calculators. The Instruction Manual leads the beginner through from first switching on to programming sophisticated graphics in BASIC, and includes the operating instructions for the printer/cassette interface. It is clearly laid out with diagrams indicating every key you need to press, even for the more sophisticated routines. The style is light-hearted, almost jokey, and makes frequent use of summaries and tests, to the extent of suggesting which parts the more experienced programmer may safely skip.

A separate book of Applications Programs which can be typed in is supplied, and again, the programs all make good use of the graphics and other facilities. The range of titles covers statistics, finance, games and graphic displays.

So much for the computer itself – what is it actually likely to use? We found that it re-awakened the programmer in us. Perhaps there was a time when you sat up half the night experimenting with loops and graphics displays? And now you can hardly summon the enthusiasm to write any programs at all? We know the feeling. And perhaps the 1500 is the answer – we certainly rediscovered the fun of writing a simple 10 line program again.

Clearly the PC1500 isn't intended for the development of heavy-weight programs, but the kind of uses to which it will be put are likely to be so individual that many people will have to write their own software. The Operating System built into Sharp's 16K of ROM extracts the best available from the limited hardware. The 26 position display can be scrolled left or right to accommodate program lines of up to 80 characters and the ↑ ↓ keys are used to view a program during development. Any section of the listing can be LLISTed on the printer.

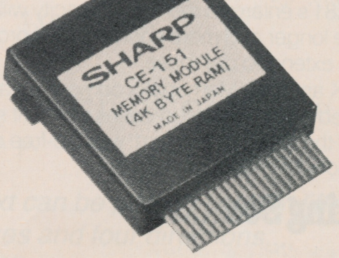
Editing is as good as on many desktop micros, with a cursor that changes from an underlining to a reversed out square when moved over existing text and 'hops' intelligently over keywords that you don't wish to change. Insert, Delete and Clear Line work as expected. The BASIC keywords, incidentally, can be abbreviated to save time, and the most common ones are pre-assigned to the QWERTYUIOP row of keys for one-touch entry.

The BASIC itself is remarkably standard with the two-dimensional arrays, string manipulating functions and two character variable names found on most larger machines, and is sufficiently compatible with Microsoft BASIC to run almost all of the routines and listings published in our magazine. In addition, though, the PC1500 sports a number of special commands that would put quite a few micros to shame.

These include: BEEP – for generating whistles and tones through the inbuilt piezo electric cell; PAUSE and WAIT which determine how long data remains on the display before continuing execution of the program; and PRINT USING which will format both numbers and text on the display – looking after the decimal places, signs and alignment as you require them. The commands for graphics we will come to in a moment.

The user gets 2.6 of the 3.5K of RAM memory to play with, though the rather peculiar memory usage system makes it difficult to assess what size of program can be handled. The STATUS command indicates that 1850 bytes are available for program listing – rising to nearly 6000 with the plug-in module, which is to say sufficient for some pretty useful programs.

Finally, we come to the Curse of the Programmer: Debugging. On the negative side, the PC1500 offers only error codes (which must be looked up in the handbook) instead of error messages. On the positive side, the erroneous line can instantly be summoned, complete with the cursor positioned on the offending character.



Minute 4K RAM expansion plugs inside the casing.

There is also a powerful TRACE facility which can be activated from the keyboard or even within a program. This executes a program one line at a time displaying the line number and permitting examination of that line or the contents of any variable without interrupting the flow of the program.

But as we observed earlier, the PC1500 is a machine to be *used* in a variety of applications, and is not ideally suited to program development. The chief asset from the users viewpoint is that programs and data are automatically preserved when the computer is switched off – so you don't have to use the cassette for storage, or type in a program every time you want to use it. And if you are thinking that that only gives you access to one program, stand by for another surprise! Most BASIC programmers will be aware that you can divide a long program into separate modules, and execute them individually by using the command RUN 100 or RUN 200 etc. The Sharp takes this process one stage further by allowing you to label sections of a program and then run them by pressing the DEF key followed by a single letter

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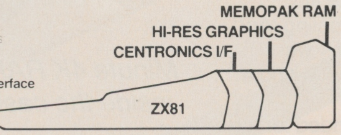

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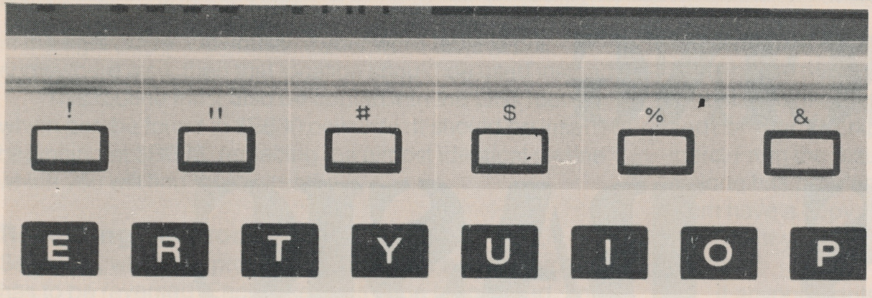


Six user-definable keys can store up to eighteen sequences of keystrokes.

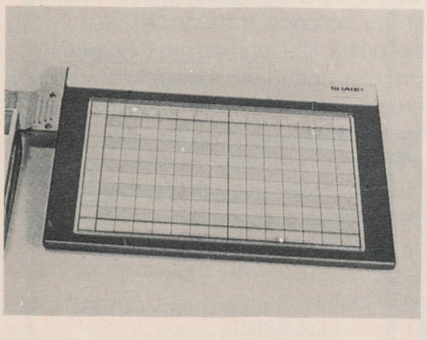
corresponding to that label. There is even an AUTORUN command which will start a program as soon as you switch on, and a LOCK command to prevent the untrained user from accidentally erasing or altering parts of the program.

The cassette system is reasonably comprehensive and should, in theory, work with any domestic cassette unit with the appropriate jack-plug sockets. For those intent on business applications handling lots of data, it is possible to use two cassettes: one for reading and one for writing. Commands exist to save your programs on cassette, load them back again, check that the recording is OK, chain from one program to another and merge a program on tape into the one you are currently developing. Both programs and pure data can be stored on tape with an appropriate filename.

Having said all that, we are less than entirely happy with the cassette system. There is no prompting to remind you what to do, nor is there much reassurance that anything is happening (except for the 'bleeper' which is supposed to indicate that data is loading), or that anything has gone wrong.

It took us quite a bit of fiddling with the volume controls to load a program successfully, and the manual gave the distinct impression that if you don't have a remote on/off facility on your reader, you are a second class citizen!

Facilities exist to design your own special characters or game symbols, occupying any number of dot positions and printing them anywhere on the display, using simple GPRINT and GCURSOR statements rather than reams of PEEKs and POKEs.



The CE-153 Software Board for individual applications.

The most useful feature, however, is the user definable keys or 'macro keys' as they are more commonly referred to. Each of the top six keys can be programmed by the user to reproduce at a single touch any commonly used sequence of normal keystrokes. This might take in anything from BASIC command words, to descriptions of your company's top-selling product lines. Again, these 'time-savers' are preserved when switched off, and because there are three such modes, you have the ability to store up eighteen sequences of keystrokes. One way to remember these functions would be to write labels on the transparent keyboard overlays which Sharp supply. Better still is the inbuilt 'soft mask' system whereby you may store and instantly recall a set of prompt-labels to appear on the display just above the user-keys.

So far, we haven't really made much reference to the printer part of the CE-150, except to observe that it is pretty well essential for developing long programs. Yet the mechanism inside this tiny device is so ingenious that it actually offers the pocket computer owner more facilities than most desktop printers. The print head supports four tiny (½" long) but replaceable ballpoint pens – giving the four colours: black, blue, green and red. It uses ordinary white paper (a 2" wide tally-roll) and prints by moving the head backwards and forwards, and the paper up and down. The result is that characters are made up from a series of drawn lines – far more readable than their dot-matrix equivalents – and a vast range of graphic effects become possible: bar charts, diagrams, patterns, and so on.

In text mode, nine different character sizes are possible, depending on the emphasis required, and naturally the amount you need to get into the width. These can be written in four different directions: across the paper, upwards or downwards and even, for Australians, upside-down. The diagrams appended to this article show some of the effects possible.

In graphics mode, the computer contains software to draw lines of a variety of different types: dotted, dashed or continuous – and, of course, in the four different colours. Lines can be drawn to any point on the paper from the point you have defined as the origin. Alternatively, you may specify a whole series of "vectors" to be drawn, one following on from the next.

This really brings us full-circle to the question of 'what can you use it for?' Let's put it another way: to whom will the PC1500/CE-150 be really useful?

Anyone who needs to present the results of their calculations attractively should be interested. How much more impressive would the double glazing salesman's quotation be if it was individually printed out, complete with a four-colour company logo drawn out by the program, and perhaps diagrams of the quoted range of products.

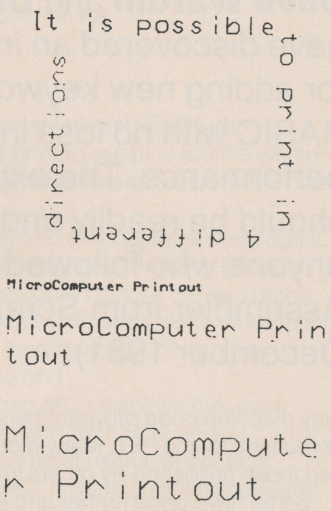
But with 6K of RAM in its expanded form, and contents preserved even when switched off, a number of other applications spring to mind. What about a portable cut-down *VisiCalc*-type tool for forecasting? Or even a diary/list of telephone numbers that could be printed out or altered at will.

Much will depend on the software that is developed, of course, though our guess is that most PC1500 users will write their own programs for one-off applications.

In summary, then, an exceptionally well designed machine that will open up a whole new field of microcomputer applications. Sharp are unlikely to deprive the desktop manufacturers of much business but those same manufacturers could learn a lot from a close study of the PC1500.

In short, we liked it. And we have a feeling that the editorial budget might have to stretch to one in the near future.

For business purposes, of course.



```
It is possible
to print in
4 different
directions

MicroComputer Printout

MicroComputer Prin
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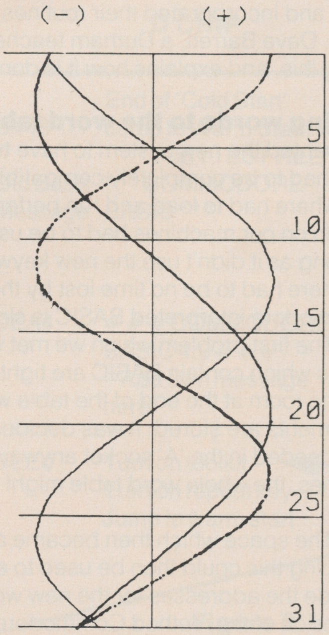
Text can be printed in nine different sizes and four directions....



Some of the graphic possibilities of the CE-150

ENHANCING PET'S BASIC

When the PET was first launched the BASIC was considered to be very user-friendly. Now, four years on, it is widely criticised for its lack of sophisticated functions and keywords. **Dave Wardill** and **Dave Barrett** have discovered an ingenious method for adding new keywords into PET BASIC with no loss in compatibility or performance. The explanation below should be readily understandable by anyone who followed our series: Assembler from Scratch (July to December 1981).

Many machine code programmers have written their own subroutines for the PET. Many more have collected and used those published by others in magazines.

Some have gone further and have burnt these routines into EPROMs so that they are permanently available, without having to be reloaded at the start of each session, and where they don't take up space in RAM.

However, relatively few people have taken the ultimate step, and incorporated their routines as a part of BASIC in ROM. Dave Barrett, a Durham teacher, has succeeded in doing this, and explains how it is done.

Adding words to the word table

We wanted the new system to have two important features:
(1) It had to be completely compatible. Any program written elsewhere had to load and run perfectly, and any program written on our machines had to be usable on standard PETs (as long as it didn't use the new keywords, of course).
(2) There had to be no time lost by the new system. Commodore interpreted BASIC is slow enough as it is.

The first problem which we met was that of space. The ROMs which contain BASIC are tightly packed, and there was no room at the end of the table where the BASIC statements are stored. It was decided that as another chip was needed in the 'A' socket anyway, containing the extra routines, the whole word table might as well be moved there.

The space which then became available in the 'B' chip by doing this could then be used to extend the jump table to include the addresses for the new words. This is an extension of the method Commodore used when they expanded their own word tables to include the disk commands for BASIC 4.

The rearrangement of the 'B' chip can be seen in Fig. 1.

It was also necessary to alter some of the coding in the 'B' chip so that it pointed at the new table. This had the major advantage that the standard interpreter does all the work for us, because it is already set up to tokenise and find the jump addresses.

This also meant that we could take advantage of the inbuilt routines which already exist in the PET. Certain new keywords could be included whilst using very little space. For example, PLIST, which lists directly to the printer, takes hardly any room at all on the new chip. Additionally, this meant that we did not have to intercept the Chargot routine. Certain add-on chips, such as Toolkits, do this so that commands are diverted through the chip. Thus, the new words used on the chip can be recognised and acted upon. However, a significant time penalty is incurred by this when BASIC is running, as each character is diverted and examined.

Our method avoids this time penalty, and also allows our new BASIC to be compatible with these add-on chips!

In order to maintain compatibility with the existing organisation inside the PET, no new zero page locations were used. Consequently, we have tended to use temporary work areas other than the known 'free' locations in zero page. The only place where this rule was broken was in the REPEAT key routine. To get round that problem, we don't turn on the repeat key if we are using a sensitive routine.

Tokenising

The next problem was to see exactly what happened to each BASIC word when it is stored in memory. It is not stored in full, for this would be far too extravagant with memory. However, a routine checks each word in your program and checks it against the word table. If it finds a match, then it replaces the word with a token, a number between 128 and 202. For instance, the word NEW becomes 128; FOR becomes 129; and so on. On Series 4 machines, with 14 extra disk commands, the token numbers go up to 218. Therefore, the remainder of the tokens, up to 255, were available for our use.

The routine to do this was discovered in the 'B' chip, between $B4F6 and $B5A2. There were only two bytes which needed changing. These contained the address of the new location of our word table, which was moved to $A001.

The routine looked like this:

```
B533   A9   B0      LDA#$B0
                    STA$20
                    LDA#$01
                    STA$1F
```

After the change, the new word table was accessed like this:

```
B533   A9   A0      LDA#$A0
                    STA$20
                    LDA#$01
                    STA$1F
```

This sent the interpreter to look for the new word table in the right place. Obviously, if your word table is put somewhere else, then that location should be used instead.

This routine must also be copied into the LIST routine, which can be found in $B630 onwards. It should be inserted beginning at $B6B8, replacing the almost identical routine which you will find there already.

Reversing the process

Secondly, when the program is running, the whole process has to be reversed. Each token has to be recognised, and the program flow diverted to the right subroutine in ROM.

The subroutine which does this is located in the 'B' chip, at $B785–. Unfortunately, there was not enough room to squeeze the changed routine in at this point, so a jump was inserted instead, pointing near the end of the chip. There is quite a lof of unused memory there.

The 'jump' change looked like this:

```
B78F 4C    50    BF JMP $BF50
```

– and the new routine introduced near the end of the chip looked like this:

```
BF50 C9 5B CMP#$5B         ; Is it a new token (>218)?
              BCS$BF60 ; Yes – goto BF60
```

Next, the routine checks for functions, as before.

Then it sets its new jump address and goes to the Chargot routine:

```
BF60     SBC #$5B
         ASL
         TAY
         LDA #$(New jump table high address, Y)
         PHA
         LDA #$(New jump table low address, Y)
         PHA
         JMP $0070 ; goto Chargot routine
```

Making the changes

Can anyone make these changes? The easiest way is probably to use a program such as EXTRAMON to make a copy of your 'B' chip in RAM, and then effect the changes there. From the results of this, an EPROM can be burnt. If anyone has problems with this, we would be glad to let them have a copy ready for burning, or even a completed EPROM. If you need any help, give us a ring on Durham 711380.

If anyone wants more information, or wants BASIC 2 equivalents, we will probably be able to help as well.

Security chip

At the same time, Dave Wardill was taking a good look through the 'D' chip. His attention was taken by the COLD START routine, which is activated whenever the PET is switched on. This routine does several jobs. It dumps a copy of the Chargot routine into zero page, checks and counts all the available RAM, and displays the familiar

```
### COMMODORE BASIC 4.0 ###

xxxxx BYTES FREE
```

Two facts were of particular interest. Firstly, the 'Commodore' message was printed out by a routine which copied a series of memories to the screen until it met a byte containing 00.

It was a simple matter to add an additional message to the end of the official one – particularly simple in BASIC4, because there is no further program before the end of the chip. In BASIC3, however, whilst it is possible to change the official message, it can't be lengthened, as it is in the middle of the ROM, not at the end.

So, when his PET is turned on, it displays the usual messages – and then follows with his name, address and phone number. This would be most useful for security reasons, were it not that his PET is fairly distinctive already. Considering the number of modifications under the bonnet, it is not surprising to find him concede that the guarantee is probably now voided!

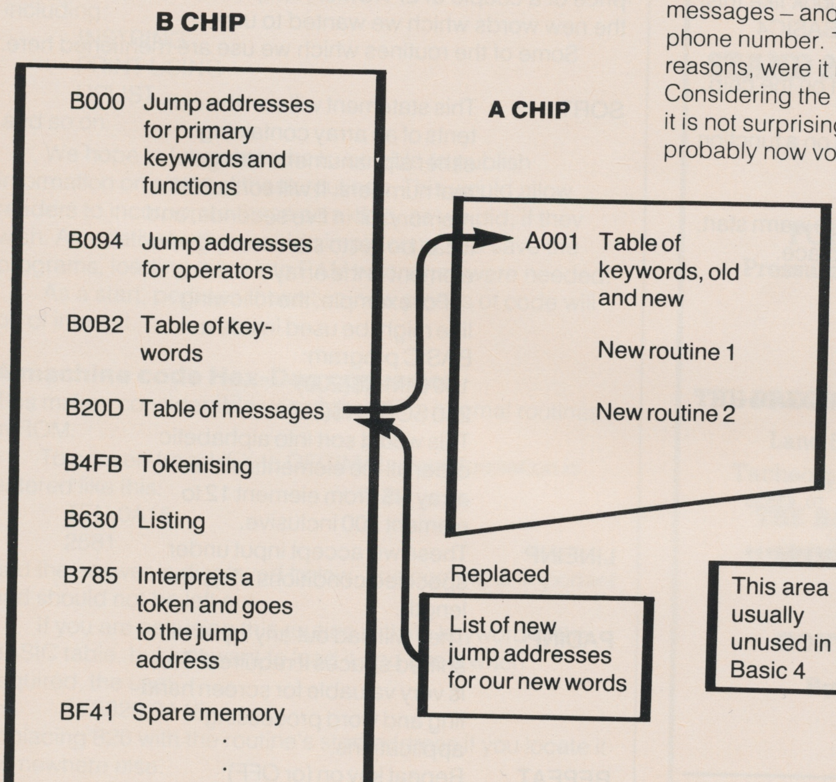

B CHIP
B000 Jump addresses for primary keywords and functions
B094 Jump addresses for operators
B0B2 Table of key-words
B20D Table of messages
B4FB Tokenising
B630 Listing
B785 Interprets a token and goes to the jump address
BF41 Spare memory
BF60 Check to see if new token.
A CHIP
A001 Table of keywords, old and new
New routine 1
New routine 2
Replaced
List of new jump addresses for our new words

Figure 1

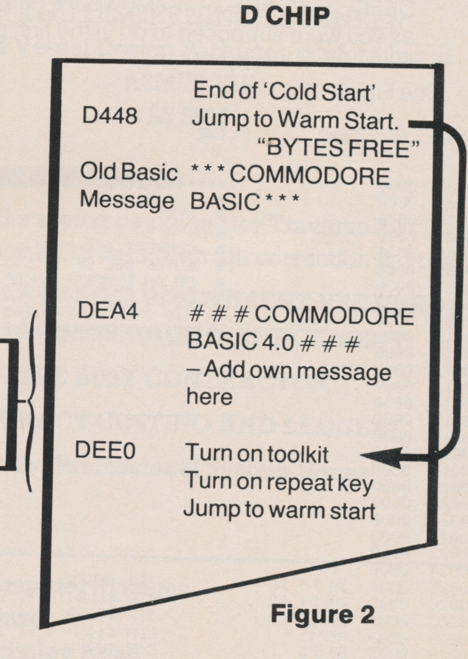

D CHIP
D448 End of 'Cold Start' Jump to Warm Start. "BYTES FREE"
Old Basic Message *** COMMODORE BASIC ***
DEA4 ### COMMODORE BASIC 4.0 ### – Add own message here
DEE0 Turn on toolkit Turn on repeat key Jump to warm start
diverted to
This area usually unused in Basic 4

Figure 2

PET'S BASIC

Toolkit turn-on

A second feature was discovered at the same time, one which will be of especial use to users with Toolkit type chips.

Add-on chips normally have to be activated after the PET is switched on, using a SYS command. However, the routine described above ends with a jump to the Warm Start routine. This jump can be diverted to some of the empty space at the end of the 'D' chip, and from there the Toolkit can be activated, along with the Repeat Key if desired. This means that when the PET is turned on, it automatically activates any extra chip or chips, and enables any desired function without any action on the operator's part whatsoever.

These processes can be seen in the 'D' chip as follows:

```
DEA4     2A 2A 2A 20 43 4F 4D 4D ###  COMM
DEAC     4F 44 4F 52 45 20 42 41 ODORE  BA
DEB4     53 49 43 20 34 2E 30 20 SIC 4.0
DEBC     2A 2A 2A 0D 0D 00         ###
```

The 'OD' is the symbol for 'carriage return'. Remove the zero in memory $DEC1 and merely add your own message.

The jump routine which has to be diverted is earlier in the chip, at $D448.

```
D448     4C FF B3     JMP $B3FF
```

This should be changed to something like

```
D448     4C E0 DE     JMP $DEE0
```

and the program for activating the add-on will look like this, starting at $DEE0, which is unused normally in BASIC4.

DEE0   20 00 A0   JSR $A000 ; turn on the chip.

DEE3   20 19 A1   JSR $A119 ; turn on a function at $A119 – like a repeat key.

DEE6   4C FF B3   JMP $B3FF ; go to warm start, as you were supposed to do in the first place.

See Fig. 2.

```
LINE# LOC   CODE          LINE

0001  0000                ;********************************
0002  0000                ;*
0003  0000                ;*  HEX
0004  0000                ;*
0005  0000                ;*  CONVERT DEC->HEX
0006  0000                ;*  ENTER DEC UP TO 65535
0007  0000                ;*  OR AN EXPRESSION UP TO 65535
0008  0000                ;*
0009  0000                ;*  E.G SYSXXXXX,A*(B+5)
0010  0000                ;*******************************
0011  0000                ;
0012  0000                ;
0013  0000                ;
0014  0000                ;
0015  0000                ;
0016  0000                ;
0017  0000                ;
0018  0000                ;
0019  0000                ;
0020  0000                ;
0021  0000                ;
0022  0000                ;
0023  0000                ;
0024  0000                ;
0025  0000  20 F5 BE              JSR $BEF5    ; COMMA
0026  0003  20 84 BD              JSR $BD84    ; EVALUATE
0027  0006  20 2D C9              JSR $C92D    ; INTEGERATE
0028  0009  A5 11                 LDA $11      ; SET
0029  000B  85 FB                 STA $FB      ; UP
0030  000D  A5 12                 LDA $12      ; MONITOR
0031  000F  85 FC                 STA $FC      ;
0032  0011  20 17 D7              JSR $D717    ; ? HEX NO ROUTINE
0033  0014  60                    RTS
0034  0015                        .END
```

```
LINE# LOC   CODE          LINE

0001  0000                ;********************************
0002  0000                ;*
0003  0000                ;*  DEC
0004  0000                ;*  CONVERT HEX->DEC
0005  0000                ;*  ENTER HEX UP TO FFFF
0006  0000                ;*  MUST BE 4 DIGITS
0007  0000                ;*
0008  0000                ;* EG SYS XXXXX,12DC
0009  0000                ;*******************************
0010  0000                ;
0011  0000                ;
0012  0000                ;
0013  0000                ;
0014  0000                ;
0015  0000                ;
0016  0000                ;
0017  0000                ;
0018  0000                ;
0019  0000  20 10 00              JSR XY
0020  0003  85 5F                 STA $5F
0021  0005  20 10 00              JSR XY
0022  0008  85 60                 STA $60
0023  000A  20 87 CF              JSR $CF87      ; PRINT A DEC NO
0024  000D  4C FF B3              JMP $B3FF      ; READY
0025  0010  20 70 00      XY      JSR $0070       ; GET CHR
0026  0013  C9 47                 CMP #$47       ; >F?
0027  0015  90 03                 BCC OK         ; NO THEN CARRY ON
0028  0017  4C 00 BF      BAD     JMP $BF00       ; ERROR
0029  001A  20 30 00      OK      JSR XX          ; CHANGE FORMAT
0030  001D  0A                    ASL A
0031  001E  0A                    ASL A          ; SHIFT UP
0032  001F  0A                    ASL A          ; 1ST OF PAIR
0033  0020  0A                    ASL A
0034  0021  85 19                 STA $19        ; SAVE IT
0035  0023  20 70 00              JSR $0070      ; GET ANOTHER
0036  0026  C9 47                 CMP #$47       ;>F?
0037  0028  B0 ED                 BCS BAD        ; NO GOOD
0038  002A  20 30 00              JSR XX         ; CHANGE FORMAT
0039  002D  65 19                 ADC $19        ; ADD TO HI NIBBLE
0040  002F  60                    RTS            ; RETURN
0041  0030  C9 3A         XX      CMP #$3A        ; >9?
0042  0032  29 0F                 AND #$0F
0043  0034  90 02                 BCC OK1
0044  0036  69 08                 ADC #$08       ; CHANGE FORMAT
0045  0038  60            OK1     RTS
0046  0039                ;
0047  0039                ;
0048  0039                ;
0049  0039                        .END
```

New words

Well, now we know how to add new words to BASIC, for the price of a couple of EPROMs. Next, let us look at some of the new words which we wanted to use.

Some of the routines which we use are mentioned here.

SORT	This statement will sort the contents of an array containing either alphanumeric strings or real numbers. It will sort a 32K memory full in five seconds, and it can be set to start at any given element in the array. For example, the following line might be used inside a BASIC program: 100 DIM N$(200) 250 SORT N$(12) This would sort into alphabetic order all the elements of the array N$, from element 12 to element 200 inclusive.
LINEINP	These will accept input under specified conditions of type or length.
PADINP	They will pad out any input with shifted spaces if required. This is very valuable for screen handling and word processing applications.
REPEAT	Repeat key on (or OFF)
DISABLE ENABLE	The stop key can be turned on or off using these words, which do not affect the running of the PET's internal clock.
SET RESET	These words allow double density (80x50) plotting to be

	used.
VLIN HLIN	Allows lines to be plotted at any point in double density mode. The syntax is 'VLIN 40' which would, for example, draw a vertical line up the centre of the screen.
DUMPSCR	This will dump an exact copy of the screen to a CBM printer.
KEYINP	An extraordinary routine which makes the GET statement redundant. 100 A$="ABCDE" 110 KEYINP A$ This will only recognise the keys shown in the A$ string. If any other key is pressed, including the STOP or RETURN keys, they are ignored. No longer must games programs suffer with the 'Press any key – NO, not that one' syndrome.
SEEK	This is a machine code version of the 'INSTRING' routine. SEEK A$ IN B$ will search string B$(I) and will report if the string in A$ is contained as a subset. This is invaluable for Database Management systems.
DELAY	Allows any length of delay to be written into a program. No more FOR NEXT loops as delays.
VDU X,Y	Sends the cursor to any point on the screen.

Many other useful words are planned for the future, including:

INSTRING
PRINT USING
UPLIST

and so on.

We hope in future months to be able to publish information on some of these routines. This would allow readers to incorporate these on a chip, as we did, if they wish. Alternatively, they could simply copy and save the programs, loading them into RAM when they were needed.

As a start, perhaps these two new pieces of code will be of interest.

A machine code Hex-Dec converter.

This makes considerable use of the PET's internal routines in ROM.

To convert from HEX to DECIMAL, the information is entered like this:

```
TEN,0A15
2581
```

and the answer is displayed below. The comma is important and should not be left out.

If you are not using this routine with its keyword in the BASIC table, but just want to load it and use it when required, the use:

```
SYS826,0A15
```

replacing 826 with the routine's start address if you locate it somewhere else.

The conversion in the opposite direction works equally well.

```
HEX,12345
```

or, if it is being loaded into RAM, then

```
SYS826,12345
```

will do the job.

▶ 90

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DISCOUNT CASH FLO

Discounted Cash Flow is a technique for determining the best possible rate of return on an investment – whether it's buying new plant for your business, or a new washing machine for your home. With the aid of this useful program listing, you can now perform a full D.C.F. analysis on your own micro.

A bird in the hand is worth two in the bush, according to the old adage. Similarly, a pound in the pocket today is worth more than a pound expected to arrive next year, which in turn is worth more than a pound promised for the following year. The pound we have today can be earning compound interest. Looked at another way, a pound spent today is more costly than a pound not due to be spent until sometime in the future, for the same reason that the former could have been invested and earning interest.

However, the position becomes less clear when it appears possible to spend now in order to reap the benefits later. For example, lashing out on a season ticket to watch your favourite football team at home may be costly in terms of initial expenditure but is likely to be cheaper over the season than purchasing a ticket for every match (not to mention the possibly unquantifiable benefits of having a guaranteed ticket and avoidance of queuing in the rain at the ground!) Obviously, it is fairly simple to calculate the advantages of this type of investment. Things would become more complicated if, for instance, you still had to purchase cup-tie tickets, the price of admission was likely to fall during the season, or you were not likely to attend all the matches. Although there might still be a financial benefit to you, perhaps there might be a more profitable way of spending your money, like buying a video recorder (or renting one) or installing central heating, where any of these alternatives might give a better return on the investment. A further complicating factor comes when expenditure and savings (or income) occur at varying times throughout the period, and the effect this has on the flow of cash.

Rate of return

Whether it is a home or business matter, the use of a technique called Discounted Cash Flow can be very profitable. Basically, the outlay and income of cash are discounted back to see what their present value is at today's rates. A cumulative net present value over the life of a project tells us how good the investment is. A positive CPV indicates a good return, negative a poor return and zero the real rate of return. The program listed here will enable you to make sensible and useful forecasts to determine the most beneficial investment of your hard-earned cash.

The program commences by requesting a title for the analysis, followed by the number of years over which the analysis is to be carried out and the discount rate. For example, if you wanted to carry out a DCF on the purchase of a computer for your business (assuming you're running this program on someone else's!), the heading could be "Computer Purchase", the period 10 years and the rate 20%. I will continue to use this as an example.

Next, the various items have to be described. In our example, we could have Hardware, Software, Maintenance (abbreviated to Maintain to avoid truncation), Media and Savings. Typing an asterisk finishes the entries. You are now invited to type in any recurring values, together with an associated inflation percentage. Hardware is a cost in the first year only, say, so this will not be entered at this point in the program. Our recurring costs will be throughout the whole 10 years so we specify year zero (years are numbered from zero upwards) as the start year and 9 (the tenth year) as the finish year. We could have used a different range and have specified different costs for different periods.

By Bob Chappell

Benefits and savings

We skip Hardware by typing an asterisk. Against Software, we'll enter -2000 and for the inflation rate, we'll put 2. This will have the effect of placing an expenditure of 2000 pounds for year zero, with all successive years being increased each year, for this item, by 2%. Thus by the tenth year, our software expenditure in that final year will have risen to 2390 pounds. All expenditure, costs and outgoings must be entered as negative values. Conversely, all income, benefits and savings are entered as positive values (no plus sign is necessary). To obtain a recurring constant, enter zero as the inflation rate.

We'll continue by entering -1000 and 5% for maintenance, -200 and 5% for media, and 4000 (a positive value) and 10% for savings. In the last item, we are assuming a saving in business costs, increased productivity, greater efficiency, etc. at a first year value of 4000, increasing each year by 10%. The program now requests non-recurring values for any item for which it has a zero value still recorded. Hardware for year zero will be entered as -10000 and against year 1 we'll enter an asterisk to indicate that we have no further entries to make against that item.

The program will now display the menu. We will look at each option in turn. The first lets us display the table. As there is a limit to how much we can cram on the screen, the program shows only 3 years at a time. The title and item headings are displayed for each part, together with the discount rate, totals, net present values and cumulative present values (the latter is useful for tracing the progress of the analysis and seeing where a turning point in an investment appears).

The figures are all shown to two decimal places, being neatly aligned (one of Tommy's brilliant tips has been used to accomplish this!) The maximum figures that can be displayed range from -99999.99 to +999999.99. If a figure exceeds these limits, it is displayed as a plus or minus field of asterisks. Our example shows that the final cumulative present value is positive, 109.8 pounds to be exact. Using option 7, we can find out the true rate of return on our investment. The discount rate is advanced or decreased by ever smaller amounts until a present value close to zero is produced. The

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progress of the calculations is displayed on the screen to show to the user that the program hasn't got fed up and packed up for the day! We find that the true rate for this project is 20.29%, representing a fairly worthwhile investment. Displaying the table again will show the effects of this revised discount rate.

Sensitivity analysis

We can now proceed to use sensitivity analysis, that is, using "what if" features to compare various effects on our investment. Selecting option 2 will allow us to change the values in any one year without affecting the values in any of the other years (apart from totals and PVs). Let's amend year 9 to show a residual value on our hardware of +2000 and the sale of some of our software for 2000 (skip the other items by typing an asterisk). We return to the menu by typing asterisk again when asked for another year change. Displaying the table will show that the CPV has risen to 1209 pounds and using option 7 again will show that the true rate of return has risen to 23.07%, an even better prospect.

PROGRAM LISTING

```
10 rem**discounted cash flow**
20 rem**bob chappell 20/3/82**
30 gosub1630:goto170
40 rem**format routine**
50 j3=int(e(j1,j2)*100+.5)/100:v$=str$(j3):v$=right$(v$,len(v$)-1)
60 ifj3=0thenv$="  "+v$:goto90
70 ifabs(j3)<1thenv$="0"+v$
80 iflen(v$)<3thenv$=v$+".00":goto120
90 ifmid$(v$,len(v$)-2,1)="."goto120
100 ifmid$(v$,len(v$)-1,1)="."thenv$=v$+"0":goto120
110 v$=v$+".00"
120 ifj3<>abs(j3)thenv$="-"+v$
130 iflen(v$)<10thenreturn
140 ifleft$(v$,1)="-"thenv$="-*****.**":return
150 v$="******.**":return
160 rem**title**
170 gosub180:goto220
180 gosub1540:print"please enter the title"
190 print:print"(maximum length is 20 characters).":printl$:print
200 input"title";v$:t$=left$(v$,20):return
210 rem**period**
220 gosub1540:print"from 2 to 20 years can be calculated.":printl$:print
230 input"how many years do you want";y$
240 y=int(val(y$)):ify<2ory>20thengosub1570:goto230
250 y=y-1:gosub270:gosub1540:goto320
260 rem**discount factors**
270 gosub1540
280 input"what is the discount rate";v$
290 r=val(v$):ifr<0thengosub1570:goto280
300 f=r*.01:forj=0toy:df(j)=(1/(1+f))@j:next:r=int(r*100+.5)/100:return
310 rem**items**
320 print"up to 10 item descriptions can be"
330 print"entered (maximum length 9 characters).
340 print:print"type * to finish.":printl$
350 te=0:forj=1to10:print
360 print"item";j;:inputd$(j)
370 ifd$(j)="*"andj=1thengosub1570:goto360
380 ifd$(j)="*"thenj=10:goto400
390 te=te+1:d$(j)=left$(d$(j),9)
400 nextj:te=te+1:d$(te)="totals":te=te+1
410 d$(te)="rate"+str$(r)+"%"
420 te=te+1:d$(te)="npv":te=te+1:d$(te)="cum pv"
430 ly=0:gosub450:goto620
440 rem**recurring values**
450 gosub1540:print"please enter any recurring values"
460 print"(with minus sign if not income":print"or savings).":print
470 print"type *":print"against start year to exit."
480 print"against value to skip to next value.":printl$
490 print"start year  ("ly;"-";y;")";:inputv$:ifv$="*"goto600
500 sy=val(v$):ifsy<0orsy>=yorsy<lythengosub1570:goto490
510 print:print"finish year (";sy+1;"-";y;")";:inputv$
520 fy=val(v$):iffy<=syorfy>ythengosub1570:goto490
530 ly=fy+1:forj=1tote-4:print:printd$(j);" value";:inputv$:v=val(v$)
540 ifv$="*"goto590
550 print:input"annual % inflation";v$:a=val(v$)/100
560 ifa<0thengosub1570:goto550
570 e(j,sy)=v:forj1=sy+1tofy
580 e(j,j1)=v+v*a:v=e(j,j1):nextj1
590 nextj:ifly<ygoto450
600 return
610 rem**non-recurring. values**
620 zz=0:forj=0toy:z=0:forj1=1 630 ifzz=1goto730
630 ifzz=1goto730
640 ife(j1,j)<>0goto730
650 ifz=1goto700
660 z=1:gosub1540:print"please enter non-recurring values"
670 print"(with minus sign if not income":print"or savings).":print
680 print"type * to exit":printl$
690 printtab(10)"year";j:printtab(9);"---------"
700 printd$(j1);:inputv$
710 ifv$="*"thenzz=1:goto730
720 e(j1,j)=val(v$)
730 nextj1:nextj
740 gosub760:goto830
750 rem**totals**
760 cm=0:forj=0toy:j2=0:forj1=1tote-4
770 j2=j2+e(j1,j):nextj1:e(te-3,j)=j2
780 rem**net present value**
790 j2=j2*df(j):e(te-1,j)=j2:e(te-2,j)=df(j)
800 rem**cumulative present value**
810 cm=cm+j2:e(te,j)=cm:nextj:return
820 rem**options**
```

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DISCOUNTED CASH FLOW

Using option 3, we'll change the discount rate to 25% and after displaying the table, will find the final CPV has fallen to a negative figure, which indicates that our investment, if this rate prevailed, would not be very fruitful, costing some 2% more than we should get back. Options 4 and 5 allow us to change the text of the items and title respectively.

Option 6 permits us to change any of the recurring values. We'll select years 2 to 6 and enter 7000 and 6% for savings, assuming that we expect a sudden jump in the savings at year 2 with a drop in the increase rate to 6%, terminating at year 6 (years 0,1,7,8 and 9 will be unchanged). Typing asterisks at the appropriate prompts will allow us to skip the other items and years. Displaying the table shows a greatly increased CPV (some 4598 pounds) with a true rate of return up from 23.07% to 34.83%, a truly gratifying return for our money!

The final options, 8 and 9, allow us to start a completely new table (effected by issuing a RUN command within the program) or to end the session. Following the example through as described above will help you become familiar with the program's capabilities.

One enormous improvement that could easily be implemented is the option to print out the table to a hard copy device. Since printer routines vary somewhat between micros, this has deliberately been omitted. Another enhancement you may wish to make is the option of having periods other than years, e.g. monthly, quarterly, half-annual, etc. Even without these additions, you should find the program useful at both home and business.

Major Variables

DS( )	Description of each item
E(i,y)	Values – i is item, y is year. The last 4 i groups are for totals, rate of discount, net present value and cumulative present value.
DF( )	Discount factor for each year.
TE	Total items in arry E above, including the 4 mentioned.
Y	Number of years over which DCF is to be carried out.
R	Current rate of discount.
SY	Start year of recurring set of values.
FY	Finish year – " – – " –
CM	Current cumulative net present value
CL	Previous – " – – " –
R1	Previous discount rate.

REMs give information as to what each section is doing – they may be deleted. Program runs in about 7K. The version listing given here should run on any PET (note that the clear-screen symbol has been replaced by a capital 'C') but has been specifically designed to be easily converted to any other machine. In case of difficulty, refer to our 'How to Translate BASIC' series starting December 1981.

```
830 gosub1540
840 printtab(5);"options"
850 print:print"(1) display the table."
860 print:print"(2) amend a year."
870 print:print"(3) amend the discount rate."
880 print:print"(4) amend an item description."
890 print:print"(5) amend the title."
900 print:print"(6) amend a recurring value."
910 print:print"(7) calculate the true rate of return."
920 print:print"(8) start a new table."
930 print:print"(9) end the session.":print
940 input"option number";v$
950 n=int(val(v$)):ifn<1orn>9thengosub1570:goto940
960 onngosub990,1100,1240,1270,1340,1360,1380,1500,1520
970 goto830
980 rem**display table**
990 k=int((y+3)/3):n=0:forj=1tok:gosub1000:n=n+3:nextj:return
1000 print"C";t$;tab(22);"year"
1010 n1=n+2:ifn1>ythenn1=y
1020 tb=13:forj1=nton1:printtab(tb);j1;:tb=tb+10:nextj1:print:printl$
1030 forj1=1tote:ifj1>te-4thenprintl$
1040 printd$(j1);:tb=18:forj2=nton1
1050 gosub50:printtab(tb-len(v$));v$;
1060 tb=tb+10:nextj2:print:nextj1:printl$
1070 ifj<kthenprint:print"press space for more of the table":gosub1600:return
1080 gosub1590:return
1090 rem**amend year**
1100 gosub1540:print:print
1110 print"which year do you wish to amend":print
1120 print"( 0 to";y;"or * to exit)";:inputy$
1130 ify$="*"thenreturn
1140 y1=val(y$):ify1<0ory1>ythengosub1570:goto1110
1150 gosub1540:print"please enter the values"
1160 print"(with minus sign if not income":print"or savings)."
1170 print:print"type * to skip an item.":printl$
1180 printtab(10)"year";y1:printtab(9);"--------":forj1=1tote-4
1190 printd$(j1);:inputv$
1200 ifv$="*"goto1220
1210 e(j1,y1)=val(v$)
1220 nextj1:gosub760:goto1100
1230 rem**change rate
1240 gosub270:gosub760
1250 d$(te-2)="rate"+str$(r)+"%":return
1260 rem**amend item**
1270 gosub1540:forj=1tote-4:printj;d$(j):print:next
1280 input"which number (type * to exit)";v$:ifv$="*"thenreturn
1290 j=val(v$):ifj<1orj>te-4thengosub1570:goto1280
1300 gosub1540:print:print"please enter the new description"
1310 print:print"(maximum length 9 characters).":printl$
1320 input"new entry is ";v$:d$(j)=left$(v$,9):goto1270
1330 rem*change title**
1340 gosub180:return
1350 rem**change recurring value**
1360 ly=0:gosub450:gosub760:return
1370 rem**find true rate of return**
1380 print"C":print
1390 r1=5:cl=cm
1400 gosub300:gosub760
1410 print"C":print:print"working"
1420 print:print"rate";int(r*100+.5)/100;"cnv";int(cm*100+.5)/100
1430 ifabs(cm)>abs(cl)thenr1=-0.5*r1
1440 ifabs(r1)<.005goto1460
1450 r=r+r1:cl=cm:goto1400
1460 r=int(r*100+.5)/100:print"C":print:print"true rate of return is";r;"%"
1470 d$(te-2)="rate"+str$(r)+"%"
1480 gosub1590:return
1490 rem**new table**
1500 run
1510 rem**end session**
1520 print"C":print"session ended.":printl$:end
1530 rem**title**
1540 print"C";tab(8);"discounted cash flow"
1550 printl$:print:return
1560 rem**error message**
1570 print:print"inadmissable value - please try again.":print:return
1580 rem**halt**
1590 print:print"press space to continue"
1600 getv$:ifv$<>" "goto1600
1610 return
1620 rem**initialise**
1630 dimd$(14),e(14,19),df(19)
1640 l$="---------------------------------------"
1650 return
```

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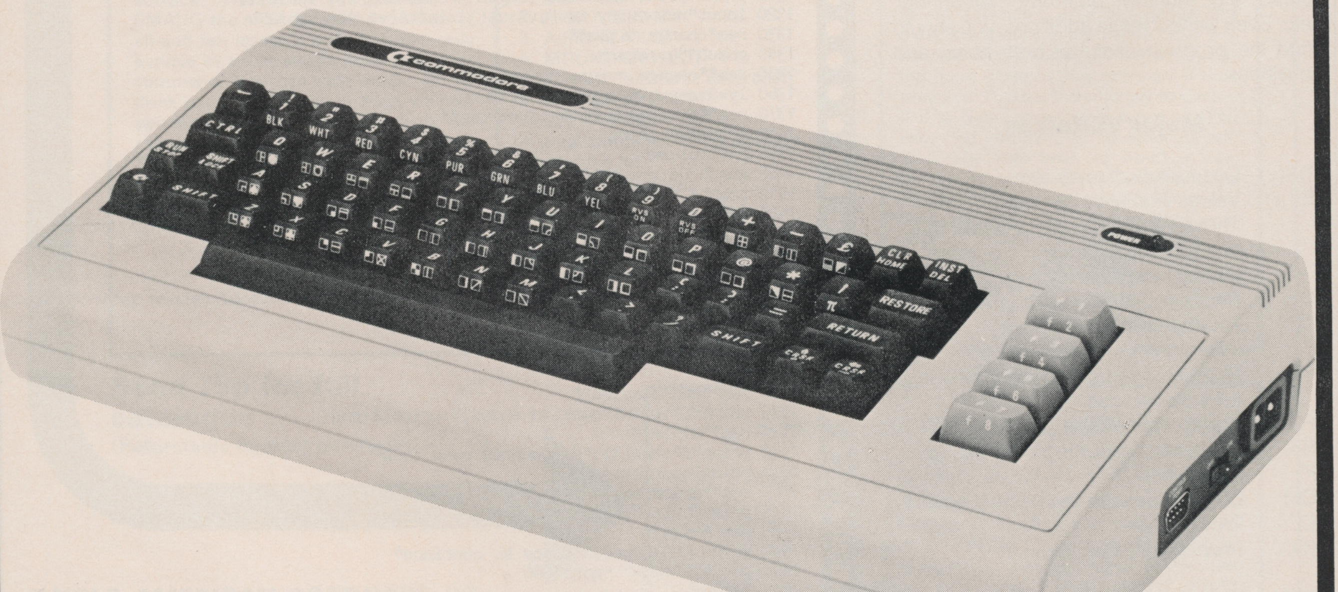

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THIS DESIRABLE RESIDENCE

Though many people harbour an inherent distrust of estate agents, their task is not always an easy one. Microcomputers, as **Martin Hayman** discovered, can ease the administration side, but may be helping to put estate agents out of business.

It is not difficult for anyone who has ever sold a house to write the ideal brief of the character of the estate agent he would most like to engage. He would be sympathetic, discreet, of irreproachable moral standing; scrupulous, yet endowed with the financial acumen needed to clinch the sale on the best possible terms (for the vendor of course); possessed of a subtle knowledge of human nature and incisiveness of mind to sort out from his slew of contacts the one, or several, who will most be attracted by the polished boards, Indian rugs, marble fireplaces and fine orientation of the home you love so well, and undeterred by the dodgy neighbourhood and the underspecified heating which you have learned to combat with a range of thick pullovers.

Such a person would be a veritable angel. Those who orchestrate the sale of houses are likely to fall short of such an ideal of perfection, but not so far as many people would imagine. The fact of the matter is that many people do see estate agents as those who have wilfully embraced the path of darkness and followed Satan into the pits. This is unfortunate for the folk of this rather equivocal profession – equivocal because it has no professional requirements for its practice and indeed, until the enactment of the recent Estate Agent Act, no way of barring its black sheep or, as the suffering clients of such malefactors doubtless feel is more appropriate, driving them down into the flames where they belong.

Honest brokers

Perhaps estate agents should better be described as honest brokers. In any case, they appear to be in need of computers. What could be simpler and more appropriate, for the enterprising software house, than to run up a few modified matching programs to take out the donkey work of matching and mailing vendors and applicants, thereby, so the argument runs, improving the estate agent's productivity, uncluttering the mind for genuine creative hunches, cutting the clerical bill and lengthening the lunchtime?

It's not that it has not been tried. It has, but the results have in many cases proved less than satisfactory, or even disastrous. David Perkins, of the Guildford-based agents Andrews & Partners, who has been a president of the National Association of Estate Agents and an active member of their computing ginger group so has no Luddite tendencies, told me: "From the computing point of view, everyone who has a computer to market is asking 'Who can we market it to? Estate agents!' And they think, hey presto, everything's going to be perfect. There are dozens of systems offered, and one or two have even been bought. But the trouble is that they're not put together by estate agents. Computer people seem to believe that it's simply a question of matching, but it's not. It's about dealing with people.

"There's no way that a computer can measure motivation and assess pressure on people and their personal tensions. Nobody sells a house for fun – they may have problems of employment or retirement – all of which they think will be resolved by moving." Lesson number one, then, is that estate agents are dealing with people at a period of

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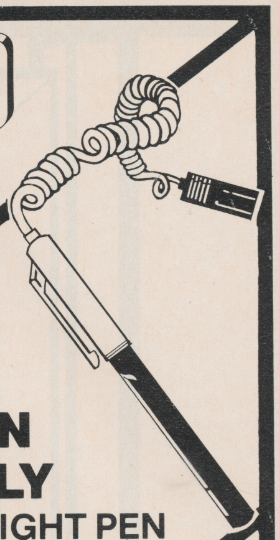

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high stress in their lives. Much to do with a family's life may hang on the successful sale of their home, and hence on their dealings with the estate agent. If for any reason the sale fouls up, then the estate agent gets dumped on for any number of reasons which may not be connected with the work he has done, but with the intrinsic problems of that family's life. Obviously, as Mr Perkins points out, these are unquantifiable factors; only human insight can gauge the amount of "play-acting" (Perkins's word) involved in the process of selling.

Human factor

What, then, of the areas where a computer can more usefully be deployed, in winnowing out useful contacts from dud ones, leaving the human factor to be assessed by an eyeballing session? In a business which is characterised by a low total success rate – overall only around one-fifth to one-sixth of all contacts initiated result in a signed contract – the computer can help, but only if it aids a manual system which is already efficient. Some estate agents who are unprofitable have tried to take on computing in an attempt to improve profitability, but without success. Systems need to be designed either by estate agents, or by software writers in regular contact with the business. Perkins makes the point that there is terrific diversity of approach: "There are 15,000 estate agents in the country and 15,000 different ways of doing it. I can make estate agents in one part of the country laugh out loud about the way things are done as standard practice in different parts of the country."

This robust individualism clearly militates against "standard" software packages. Perkins warns that any package written for one way of working is unlikely to be acceptable to another agent, so software should be capable of easy modification. The Estate Agents Act, though, should have a homogenizing effect on practice and bring nearer the notion of a standardised national norm. There is no doubt that clever communications and mass storage are already making changes; it would be quite possible, for example, to list every single property on sale in the UK on one database, but since fewer than 5% of vendors are making long-distance transfer, it is a nugatory exercise.

Estate agents are nevertheless beginning to pool their resources, notably by sharing computers. There is a consortium of 12 agents in Sussex with 200,000 properties on file and others in Bristol, Blackpool, and soon London. The potential for interlinking is there. Property World offers an ICL DRS-20 with an estate agency package for around £25 a week with word-processing thrown in, plus a communications line to a mainframe at another £7. "Before long people won't be able not to have it," comments Perkins. It looks as though the days of the estate agent who believes that "the computer won't take over from me" may be numbered.

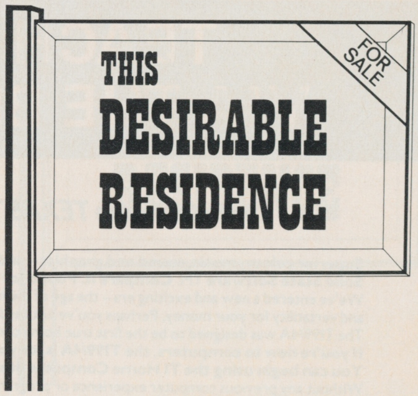
Certainly, what large-scale databases offer the public is above all economy of scale. What do people want when selling their homes? Perkins asserts that it is the largest possible market-place. What is the charismatic estate agent's 200 applicants set against the computer's 200,000? Point one per cent. As general familiarity with the micro grows, people will be surprised not to see one used in this context and may suspect that the electronically unassisted agent is over-rating his personal ability to find the right buyer.

Futuresell

Vendors, and the public at large, are surprisingly open to manipulation, although their largest asset may be at stake: Perkins mentions that when a firm called Whitegate, based in the North of England, decided to offer estate agency by leasing time on the Provident Mutual Association's mainframe, it had a terrific response from the public. This was not so much because of the proven excellence of the service, though it might well be good, but because it was prompted so heavily on TV, with Raymond Baxter telling the punter that this was futuresell. High technology does have its appeal – and perhaps its appeal is its very impersonality.

Many vendors do actually wish to purge the whole process of anything to do with estate agents. These people are known in the trade (sorry, profession) as "fizzbows" (For Sale By Owner/s). They are the kind of people who advertise in the back pages of the Sunday Times or of local papers, and they are taking on a lot of work in order to save the 2½% which agents normally feel able to claim on the sale price. But there is an alternative: with the increasing appeal and proven effectiveness of the micro at certain repetitive tasks, could it not be used just as an introductory agency for those who feel they have no need of the intervention, charismatic or otherwise of the agent?

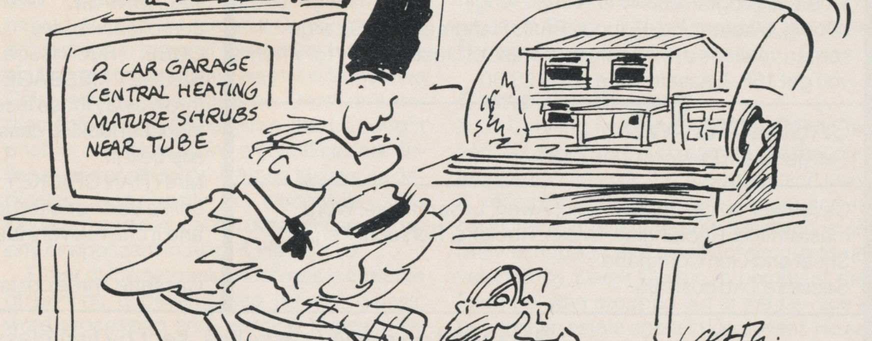
This is a market sector which Tony Pearce, a graduate of the Cranfield School of Management and who learned his computing as a civil engineer, has exploited vigorously with his Homeline agency. Until now we have heard mainly about mainframes, or at the very least a little local intelligence communicating with a remote database. What Pearce has done is to use the flexibility and compactness of the micro, along with clever marketing, to mop up a great deal of the fizzbow business, and snatch some of the kosher High Street agents' business. Pearce argues that the genuine estate agent has to charge his percentage – which can be 3% for non-exclusive agency in London – for posh premises with high rates, expressive decor and Dallas lookalikes for the front office.



Homeline's premises need to house only a few Apples, a hard disk and several bods in sweatshirts and jeans. Since the client never comes to the office, the agent can economise on his image (though whether Homeline would appeal so well if it were based in Battersea Bridge Road rather than Kensington Mall is a moot point).

Wide boys

Homeline's catchment area is London, where 21% of sellers are fizzbows. Its aim is to mop up most of that market. So far Pearce is doing well; so well is he doing, in fact, that he has successfully franchised the Homeline operation to 14 provincial centres, supplying hardware, software, which he wrote himself, and the sales talk and training. These are areas where, unlike London, conventional estate agents insist on sole agency and charge only 2½%. Pearce claims he now has 5% of the London home market, which is not bad going for one who started out less than three years ago. He also claims to sell one in three properties handled. To some extent Pearce has benefitted from the setback to the estate agent's image consequent on the palmy property days of the London boom ▶



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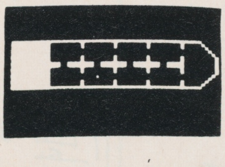

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of 1970/73, when any number of wide boys, seeing the escalating price of houses and imagining easy pickings, set up as agents with little knowledge and fewer scruples. But Pearce must take most of the credit for seeing exactly how the micro could best be used to sell houses, and marketing his service right.

Homeline's charge is a £2 per £000 up to a maximum of £90 to sellers, and no cost to buyers. For this you get 40 days on the computer and a constant watchful eye. Pearce's programs include routines to analyse the matches on a property; if for example it has achieved a suitable number of matches but aroused no interest among buyers, then the vendor is alerted that he is probably charging too much. As with any other goods in these straitened times, pricing is of the essence. Many people – 80%, Pearce estimates – reckon to know exactly what their house is worth: just a little more than the one next door. It is the optimistic extra few thousand which puts off prospective purchasers. Any estate agent could tell you that, of course, from his fund of human and local knowledge; however, he's only likely to get round to telling you if you're pushing him to sell.

How is it done? There are eight Apples at Homeline's Kensington office, independently reading programs and data off a Corvus 10MB hard disk (another is due to be added shortly). Pearce says this unit has been incredibly reliable. In a year and a half, it has never been down for more than 24 hours despite, or perhaps because, it runs 360 days a year. Printer, which is used for everything, including all correspondence, is an Anadex DP9500. Security back-up is provided by floppies. If the data were to change any faster, say if the complete contents of the cartridge were to change weekly, he would consider using a "mirror" which can make fast back-ups of the Corvus disk onto video tapes (such units are supplied by Keen Computers) but this is unlikely to be necessary because houses do not sell that quickly. The Apples communicate with a communications card via a multiplexer; the Liverpool franchise operation has succeded in accessing the hard disk via the telephone line though Pearce thinks that a dedicated line such as the new Mercury network would prove more reliable.

Personal service

The basic program is indeed a search program which looks for eight criteria: price limit (upper/lower); area(s) (postal districts for London); property types; minimum requirements (bedrooms/receptions/garage/garden). New details or applicants are keyed in during the day and batch-run at night, often as many as 1,700 in one day, totalling ¼m last year. Homeline's postage bill is large, particularly since Pearce insists on sending out matches to applicants in batches of ten, to avoid "indigestion" brought on, say, by perusing too long a list. One of the administrative time-savers about Pearce's programs is its ability to handle credit-card payments. Completed forms are returned with credit card numbers. If the figure is greater than authorised, the machine pulls the payment out for telephone confirmation; otherwise the computer payslip, with completed personal details, can be remitted direct to Access, Barclaycard or American Express payment centres.

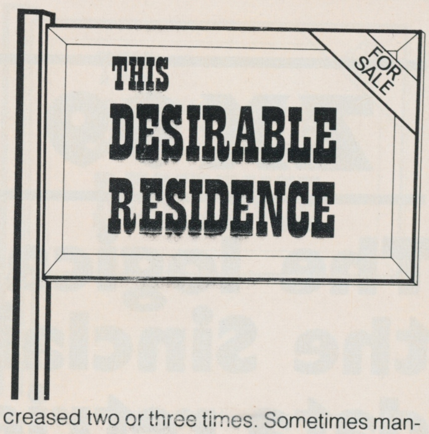
Clearly such a system does not offer the personal service of a reliable estate agent. The reasons for Homeline's cheapness have been outlined; it is net of the comfy reception area and the other, more useful, services such as mortgage broking, surveying, valuations and conveyancing which you can get at a good estate agent. These are available at a charge from Homeline. There are nevertheless many people who still prefer an inclusive package and are content, or at least resigned to seeing the percentage lopped off the ultimate sale price of the house, because they still believe in dealing with people. You might say it is because they prefer to deal with an intermediary agent rather than with the vendor direct.

Such estate agents can still benefit from the judicious use of the computer. One such partnership is the Thames Valley-based Allen & Harris, who started using a computer in what was acknowledged to be an efficient office about two and a half years ago. The instigator was Dowell Conning (as he says, we all have our cross to bear; his, for an estate agent, is his name) who told me in no uncertain terms that he had attempted to steer clear of being a "clever dick" about computing, and just got on with it. Allen & Harris's main office is a tiny place in the centre of Oxford, a very good site but too cramped to keep details of up to 2,000 properties for sale in the 10 branches in the Oxfordshire area and the staff to handle enquiries. Conning's first thought when he decided to get a computer was to use it as a simple compact storage and retrieval system. When he first put out the word that he was in the market for a computer, he said it was like a honey-pot: the salesmen descended in swarms. Conning was unimpressed by their "abysmal ignorance of our problem". Various big names tried to flog him inappropriate software bodged up from some other application at an asking price of £25-40K.

Dedicated lines

Eventually he made contact, via a West Country estate agent, with Blue Chip Software, a Yeovil concern run by Peter Tilson and Richard Spooner. He found he got on well with Peter Tilson; the personal touch, after the evidently unhappy experience with big-company salesmen, was welcome. "We make our living from sizing up people," says Conning. "Eventually we had to trust somebody." His trust was not misplaced. Where originally there were only six items on the menu of Blue Chip's software, now there are 26 and "now we do everything on the computer". Eventually the Oxford system was moved out to Swindon and Conning looked around again to see if the market had come on; however, so satisfied was he with the Blue Chip system, described as Orion and implemented on an Alpha Micro, that he bought another one. Now all the eight offices are online to one or other of the Alpha Micros via dedicated lines (costly but worthwhile, says Conning) and can get full details of any property or applicant in Allen & Harris's list.

Either of the two main machines is capable of printing a personalised list, full details, word processing and cashflow forecast. By contrast, secretarial staff, that is, girls licking envelopes, has been cut to one per office from two or three, and negotiating staff increased two or three times. Sometimes managers even input details themselves. Despite the flat property market of last year, with mortgages difficult and expensive. Conning reports that Allen & Harris has more business in the first nine months of last financial year than in any previous year, with costs only 8% up over pre-computer days. He claims that his partnership now offers a more personal service by releasing staff from the mundane druge of estate agency work.



"I can't help being a little smug, but most of the other systems I have seen are a joke," says Conning. "Some of their matches take all night. Ours takes 90 seconds." He contrasts the excellent results he has with the experience of a Hertfordshire estate agent who asked his opinion of a new system he had just had installed for the shattering price of £100K. "Do you laugh or do you cry? I just told him 'I'm sure you'll be very happy with it.' He still had only one office on-line." Conning struck lucky by resolutely avoiding being a clever dick, trusting his own judgement and thinking about his own needs rather than trying to "learn about computers". "We took the view that we were riding a tiger and we had to ride it all the way down the line," he says, neatly mixing his metaphors. "I'm still as enthusiastic as ever."

One consequence of this is that so much more business has been generated that the office now opens on Sundays, compelling the opposition to follow suit. Conning could be right when he says what the computer has brought the customer is a better service, more efficient and at the same time more personal. The big London estate agents, conservative in many ways, have cottoned on to the idea and a consortium within its number – the august Chestertons – are to go with Blue Chip's system in the near future. It is unlikely, however, that they will use Allen & Harris's local advertising slogan – "Orion: House-hunting with the Microchip". Oxford has a higher density of classical scholars than anywhere in Britain, indeed probably the world. The pun would be lost in London.

Computer literacy

If, as Conning reports, Blue Chip's menu-driven Orion software is so easy to use that punters can come in off the street and start using it, reflecting both its simple design and increasing computer literacy, the same is unlikely to happen with a suite of programs developed by Derek Caston, a computer professional who dropped out of the rat-race to become an estate agent in Deal, Kent. He envisaged a life playing golf, knocking off at five in the afternoon and walking by the sea, a contrast to the hectic life he had led as South-

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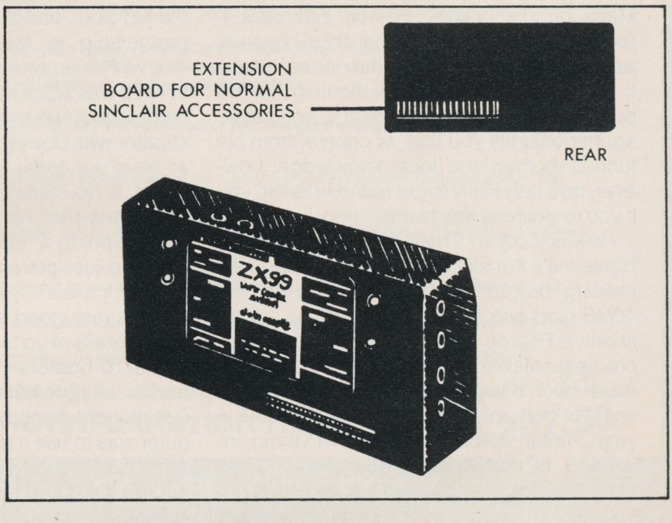
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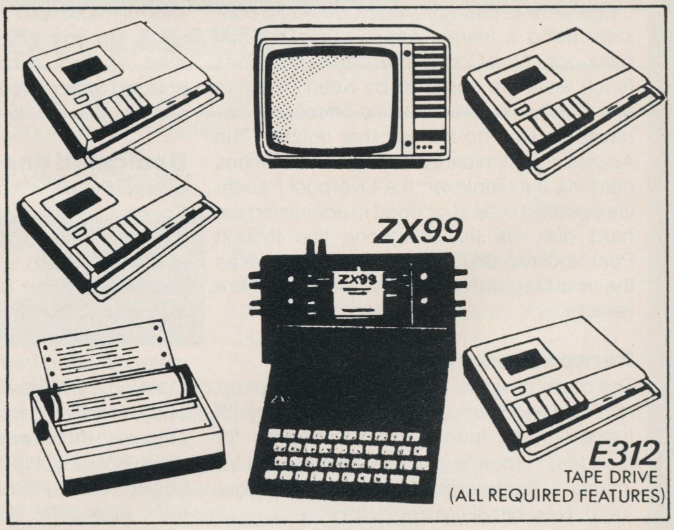
BUSINESS, EDUCATION & FUN



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East England systems support manager for ICL. He got out at the time Tony Benn at the Industry Department merged all the British computer firms to form the monolithic ICL, then described and not perhaps jokingly as "the company with the largest range of incompatible products in the world".

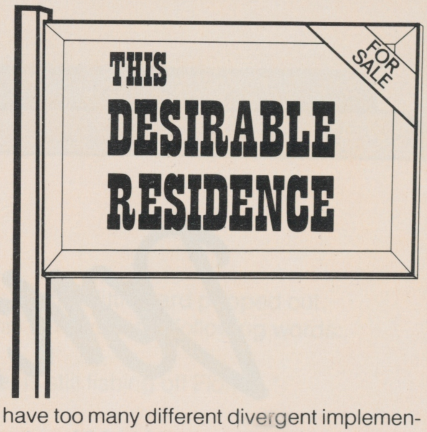
But about two and a half years ago Caston, intrigued by the micro and perhaps, dare I suggest, a teeny bit bored with so much relaxation, decided to computerise the firm of Dalton and Woodward. It was to be a cheap but comprehensive exercise based on that cheapest of all micros, the Tandy TRS-80. He set out to use optimisation techniques, making extensive use of Boolean algebra, on the operations of an estate agency, seeking to reduce its principal costs of labour and advertising. He started with the premise that the computer would look at the matching process in the same way as a negotiator would judge what sort of property an applicant might buy, and dismissing immediately those which he would not buy. Hence a program which successively purges unsuitable properties from the total number of properties held until a suitably-sized portfolio is reached. This file, containing the folio numbers of the property details (held separately as printed material) is written to the applicant file and a label with the applicant's name and address plus folio numbers printed out. Then all that is required is for the office staff to get out the relevant details, stick them in the envelope, stick the label on the envelope and take it to the post.

One refinement of the program is its ability to weigh probabilities. The saleability of the property and the likelihood of the applicant to buy can both be assessed beforehand and entered as part of the optimisation technique. This provides a "useful matrix", which sounds to me rather like the computer emulating the agent's much-vaunted hunch or charisma. Another feature of Derek Caston's program, which contains so many smart ideas that it takes four hours for *him* to demonstrate it, is its ability to write the advertising copy for newspapers, boiling down the property details to the appropriate length for the cost of the medium up to a pre-assigned ceiling. Unfortunately the National Graphical Association will accept only fully made-up advertisements, or insists on setting them itself, so this idea for the moment is running at half-cock.

Multiple screens

Why the choice of the Tandy? At the time of purchase, says Caston, it was the cheapest micro offering sufficient storage. It had 8in disks, allowing him up to 3,000 properties and 2,000 applicants on-line. Now he is looking further and is thinking about multi-screen, multi-program systems. He says he will continue to work with compiled BASIC because of its efficiency. You can get down to bits within bytes, he says, which makes it slower to write but quicker to run. He says he would not consider Microcobol (grossly inefficient), and Fortran and Pascal are out because they are slow-running though quicker to write. Who am I to disagree, when a man says he has 20 years of experience and is equally at home with a logic board as he is with programming and operating systems?

Caston will soon be doing an MP/M implementation of the TRS-80 system, which is known as Trek but it is not his intention to



have too many different divergent implementations of the program: he prefers a turn-key system which he is able to support properly. It is already being marketed and he has progressively grander ideas which will mean his joining forces with another company to sell other complementary systems as well as a large-scale multi-listing mainframe system with 3-400MB of storage serving independent terminals which could access all the properties on sale in one area and doubtless the price of installing central heating and calculate the increase in temperature for a given thermal input for any property you might be interested in. Caston is really beyond the pale as far as most agents are concerned; as David Perkins says, "The average estate agent thinks he's a loony. Estate agents just don't think like that; they want to use their little bit of personality somewhere". Suffice it to say that once bitten with the computer bug, it is never likely to leave you; after a few years of quasi-retirement, Caston is once again work-

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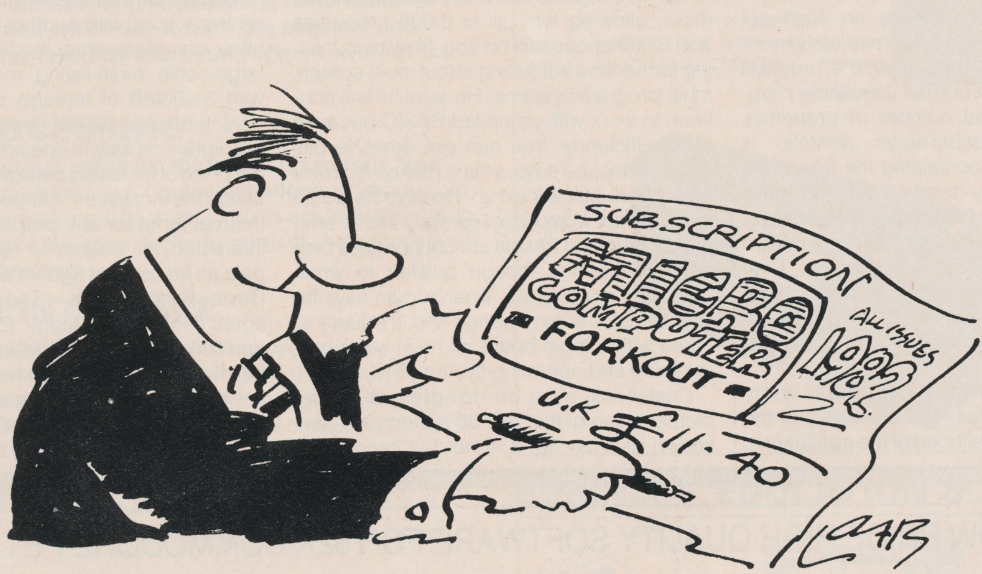
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Rex Malik's JOKE BOOK

Almost the first computer joke I can remember is what I call an Ultimate Computer Joke. And the reason for this is as follows. Right from the start, the computer was publicised as if it were a wondrous large and fast electronic brain, which in turn was bound to lead to ultimate computer/brain jokes.

The following was first found in a set of NATO engineering and computer conference proceedings in the fifties, in the days when computing was such an arcane minority craft that anything and everything the participants said was printed in full as being likely to be of interest.

The Ultimate Computer stood at the end of the line in the utlimate computer manufacturer's plant. It was meant to be the high spot of factory tours.

The party finally arrived before it. As they did so, a guide stepped forward to give them his carefully prepared patter.

"Gentlemen" he said. "This is the ultimate machine. It will give you an intelligent answer to any questions that you may care to ask it."

At which Clever Cloggs stepped forward. Every party always has a Clever Cloggs.

"May I?" he said. "By all means, Sir," said the guide.

So Clever Cloggs walked up to the ultimate computers' microphone and said, "Where is my father?"

There was a whirring of wheels and a flashing of brightly coloured lights, for the computer's manufacturer's knew that this impresed lay people. And from a slot in the front of the machine, a little card popped out.

On it were printed the words "Fishing off Florida".

Clever Cloggs read this out loud and then laughed. "I don't think much of your machine" he said. "Actually my father is dead."

It had been a trick question. The guide, carefully chosen for his ability to think fast on his feet, looked at him and said, "Sir, I am sorry that you find the answer unsatisfactory. But you must realise that a computer is very precise. And it needs to be addressed in a very precise manner. Perhaps you would care to rephrase your question and start again."

Clever Cloggs thought for a few seconds, then walked up to the machine again. This time he said "Where is my mother's husband?"

Again there was a whirring of wheels and a flashing of brightly colour lights. And from the slot in the front of the ultimate computer, another little card popped out.

Printed on it this time were the following words: "Dead."

"But your father is still fishing off Florida."

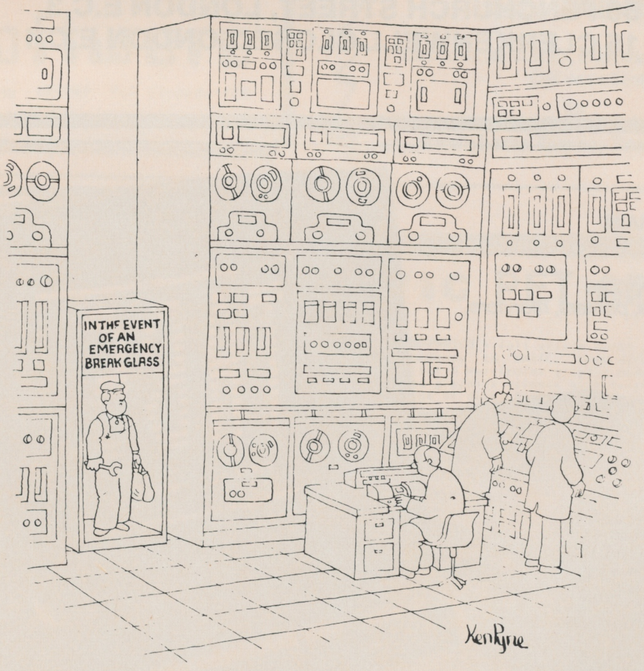
* * * * * * *

"How many Irishmen/Californians/White Anglo Saxon Protestants does it take to change an electric light bulb?" jokes have swept the industrialised world in the past few years. So at the start of the eighties, an American computing paper posed its readers the question "How many programmers does it take to change an electric light bulb?"

Among the many and varied answers were to be found the following:

None: that's a hardware problem.

Two, at least: One always changes jobs in the middle of the project.


IN THE EVENT OF AN EMERGENCY BREAK GLASS
KenPyne

Three: A programmer to blame it on the hardware and call a customer engineer. A customer engineer to blame it on the operating system and call a systems programmer. A systems programmer to say that it is an application problem and the programmer should reprogram the light switch.

Four: One to analyse the problem. One to write the instructions. One to check out and debug the instructions. And one to perform the operation.

Twelve: One to change the bulb, one for back up, and ten to write the documentation.

And lastly – No computer programmer would or could ever change a light bulb, because:

(a) It is not part of the job description;
(b) The light bulb has no addressable memory;

* * * * * * *

What follows is one of those 'there were three men' jokes, and you have to think about it. And when you have thought about it, turn away with a shudder. It's the sort of joke that's liable to drive you insane.

Pubs are places for discussion, and the discussion in this case was: What is man's most marvellous creation?

First man: I think it was the pyramids. When you think

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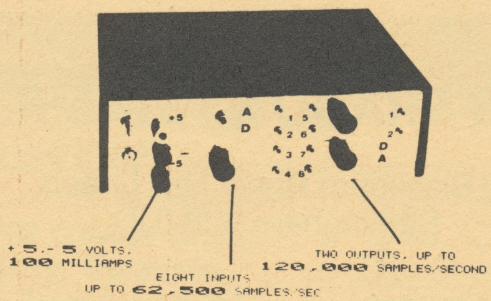

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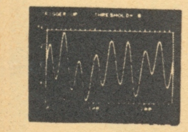

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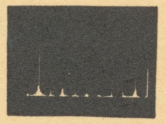

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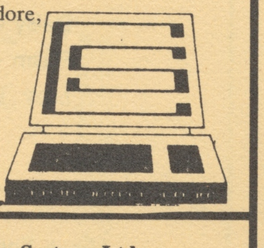

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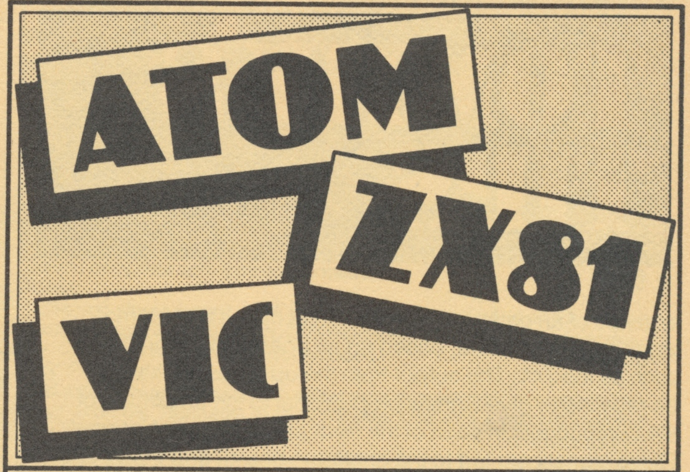

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TOMMY'S TIPS

◀ 55

intervals of an octave. The audio input has to be fed into eight bandpass filters, based on an operational amplifier such as the 741. The output from the op amps will have to be rectified to give signals proportional to the amplitude of the components in each of the frequency ranges of interest. These signals are fed to the analogue board, and from there to the PET. As the Acorn computer is also a 6502-based machine, all the signals required by the analogue board can be easily derived from the memory expansion port. The outputs from the PET will consist of eight lines, one for each octave, to be fed to the lights. The user port is ideal for this. Each line can be fed to a driver stage, and then to some sort of switch, such as a thyrister to turn the light on or off. The light driver will have to be arranged so that when the light is off, there is still a fairly large current passing through the filament, only just small enough to extinguish the light. This is to keep the filament hot during the off part of the cycle to prolong its life.

As far as the programming goes, that depends upon what you want to do with the thing, but it will have to be written in assembler as BASIC will not be able to keep up a reasonable sampling rate.

Anyone know of a PET version of "Phoenix"?

◀ 71

PET BASIC

These two routines are shown in source code. See Fig. 3.

We hope that this will give you lots of new ideas about putting your own work into the PET. The method we describe has the inestimable value of not spoiling the resident BASIC in any way. Other people's programs will run just as well as they used to, and just as quickly, for these alterations do not interfere in any way. At the same time, the possibility opens up of writing (or at least incorporating) all the words you wished PET BASIC had!

◀85

Rex Malik's

that they were created all those thousands of years ago, using only the most primitive tools, yet they are still there. That really is a fantastic achievement.

Second man: I think man's most marvellous creation was the computer. When you think that, using the computers, the Americans were able to send a man to the moon, that he was then able to grab a bucket of dust, and that using computers they were able to bring him back to earth again. That surely must be the most fantastic achievement ever.

The third man is Paddy. And Paddy says:

"I tink der most fantastic ting ever is der termos flask."

First and second man in unison: "The thermos flask?"

Paddy: "Yes. In der winter when you puts in the hot soup, it stays pipin' hot. In der summer when yer puts in der cold drink or lollies, dey stay perfectly cold.

How the bloody hell does it know?"

Shock Horror – Subroutines stolen!

Our sincere apologies to the many readers who typed in Humphrey Walwyn's ENERGIESIC program last issue, only to discover that a key section had been stolen by government spies in a fruitless attempt to cover up the awful truths about Nuclear Disasters revealed in the program.

The missing lines are reproduced below, along with our hope that you get as much enjoyment from playing ENERGIESIC as we have.

```
4565 IF R<=D(K+1)THENPRINT"ANY TIME NOW...!":ND=3:GOSUB10400:GOTO4600
4570 PRINT"AROUND THE YEAR▒"R
4575 PRINT"IF "N$(J)" INVESTMENT STAYS THE SAME."
4600 GOSUB10000:NEXT J:RETURN
6000 REM NEWS
6010 PRINT"▒"N$(J),D(K)" - "D(K+1)
6020 GOSUB10100
6100 IF P(J,K)=0 AND RND(1)>.75 THEN 6150
6110 GOTO6400
6150 PRINT"▒THE GOVERNMENT IS TAKING AN INTEREST IN
6160 PRINT"THIS POSSIBLE ENERGY SOURCE AND HAS
6165 R=INT(RND(1)*10+1)*10
6167 IF R+I(J,K)>100 THEN 6200
6170 PRINT"JUST BOUGHT UP"R"SHARES
6180 I(J,K)=I(J,K)+R
6190 GOTO6400
6200 PRINT"JUST FINANCED AN IMPORTANT SCIENTIFIC
6210 PRINT"BREAKTHROUGH. ▒IT REALLY COULD WORK!"
6220 S(J)=S(J)/(1+RND(1)*2):ND=6:GOSUB10400
6400 IF J<3ORJ>4THEN6500
6405 REM NUCLEAR
6410 IF RND(1)<J/4.2 THEN6500
6420 PRINT"▒▒OWING TO A NUCLEAR ACCIDENT,-THE COST  "
6425 PRINT"▒OF SETTLING INSURANCE CLAIMS AND SAFELY"
6430 PRINT"▒DISPOSING OF RADIOACTIVE WASTE HAS      "
6435 PRINT"▒INCREASED RUNNING COSTS FROM"O(J)"MTCE
6437 O(J)=O(J)+INT(RND(1)*NN*2+1)
6440 PRINT"▒TO"O(J)"MTCE. ***ACCIDENT NO."NN"
6445 PRINT"▒▒THE MORE ACCIDENTS YOU HAVE, THE HIGHER
6450 NN=NN+1:PRINT"▒THE RISE WILL BECOME...
6460 GOSUB10000
6500 REM
6999 RETURN
10000 GET A$:IF A$<>""THEN10000
10005 PRINT"▒▒PRESS ANY KEY TO CONTINUE■"
10010 GET A$:IF A$="" THEN 10010
10020 RETURN
10100 PRINT"————————————————————————————————————":RETURN
```

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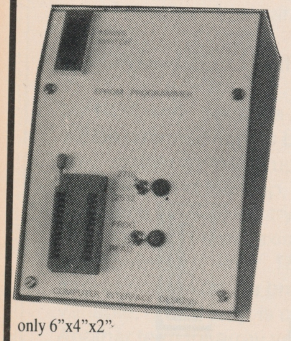

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HURRAY *for* ARRAYS!

What advantages do arrays have over normal variables, and how are they used? **Mike Gross-Niklaus** shows how this simple technique can be used to develop some advanced business programs.

Most people beginning BASIC seem to run into trouble with arrays. And that's a pity, because arrays are incredibly useful. Once you've got the hang of them you'll wonder how you ever managed without! In the first part of this article, I'll explain what arrays are and how you can use them in your BASIC programs. In the second part I'll share with you some of the uses I've found for arrays as well as some very advanced techniques they can be used for.

The need for arrays

Suppose you are writing a routine to analyse yearly sales over a five year period. The figure for each year is to be entered, the total sales calculated and then each year's sales expressed as a percentge of the total sales. Using ordinary variables you might code along the lines shown in listing 1.

If you were now asked to write a routine to analyse ten years' sales, some of you would try a FOR...NEXT loop. If so you will rapidly discover that such a loop won't work with ordinary variables. Look at listing 2. The routine will correctly accumulate the total sales figure in variable 'T', but then what? Because of the LOOP, the same variable, 'A', had to be used to receive all ten yearly sales figures, each new input overwriting the previous one. As a result, only the figure for year 10 is available, those for years one to nine have 'gone for ever', and their individual percentages can't be calculated.

What is needed is a set of variables which like items in a list can be identified or addressed by item number. So that if our list of yearly sales were given the variable name YS(), sales for year one would be assigned to YS(1), year two sales to YS(2), and so on. Microsoft BASIC as used on PET, Apple, Atari and other quality personal micros has just such a facility and it turns out to be a very powerful one indeed.

Syntax for arrays

Microsoft BASIC allows you to set up as many arrays as you need. Perhaps rather confusingly, they use the same name structures as ordinary variables, but are distinguished from them by the brackets which follow. YS is the name for a normal 'real number' variable, while YS(6) is another 'real number' variable, item six – or more correctly, ELEMENT 6 – in the Array YS. You shouldn't be fazed by this. After all you've met string variables and you know that RE and RE$ are two independent variables which can exist at one and the same time.

There is a general rule of thumb in BASIC that wherever you see a bit of syntax involving an actual number – or constant – then you can write a similar piece of syntax using a numeric variable. So, as you might guess, since YS(6) represents element 6 in the array YS, so YS(N) represents element N. If you have arranged for N to be assigned to a value of 1, then YS(N) will mean element YS(1) and if during the program N is changed to a different value, say 6, and the piece of code containing the syntax YS(N) obeyed again, this time instead of YS(1) being referred to, YS(6) will be addressed. In our example, if we have a loop containing YS(N) and each time round the loop we increment N then YS(N) will refer in succession to the sales figure for year 1 to year 10. And this is just what we need to solve the sales percentages problems using a FOR...NEXT loop.

Have a look at listing 3. As the FOR...NEXT increases the value of Y from 1 to 10, (lines 20 and 40), each year's sales figure is input into succeeding elements of the Array YS, (line 30). Notice that these elements can be treated like any other numeric variable and used in arithmetic expressions. So once input, the value in the element currently addressed can be used to update the total sales in variable 'T', (line 30 again).

When all ten sales figures have been been entered and the final total sales figure accumulated in 'T', the array elements are once more processed to provide the individual percentages, (lines 50 and 60).

The power of arrays becomes apparent when you realise that by changing 'N=10' in line 10 to 'N=500', the same piece of coding can be used, for example, to process population or agriculture statistics for historians studying the last 500 years of human endeavour in Lower Puddlecombe In The March or whatever.

Dimensioning arrays

If I were on a team redesigning BASIC, I would arrange for the array size, (i.e. the total number of elements in it), to be automatically enlarged every time during a run that an element number higher than any already created was discovered. That way, the array, which could take up a lot of RAM storage, would always be the required size and no larger. Microsoft BASIC tackles things somewhat differently, asking you to set up the array once and once only in your program to the maximum size you are ever going to need it. The statement used is 'DIM' and the best place to use it is at the start of your program, clear of any loop-backs which the coding may involve, because Microsoft BASIC won't allow you to redimension the array. That is to say: once having determined the dimensions of an array variable YS(), say, BASIC will object strongly if it comes across another DIM statement (or the same line again) which refers to that same variable. The usual error message is something like REDIMENSIONED ARRAY ERROR IN LINE...

Listing 4 shows a routine for inputting sales figures for each of 12 months in the year, working out the average monthly sales and calculating the divergence of each month's sales from that average. We need an array with 12 elements, one for the sales figures for each month, and such an array is set up in line 10 with 'DIM MS(12)'. – Yes, you could have:

```
N=12 : DIM MS(N)
```

Automatic DIMensioning

If you do forget to dimension your array, Microsoft BASIC will do it for you the first time it comes across a reference to one of the array elements. It will create an array up to and including element 10. For example, the one-line program:-

```
10 FOR I = 1 TO 10 : INPUT DA(I) : NEXT I
```

will work because even though you haven't dimensioned the array DA, Microsoft BASIC do a 'DIM DA(10)' for you when it comes across 'INPUT DA(I)' the first time round the loop. However, a similar one-line program:-

```
10 FOR I = 1 TO 11 : INPUT DA(I) : NEXT I
```

will NOT work, because although the array will be dimensioned as before, the array will only contain elements up to element 10. The last time round the loop, when I=11, the reference to DA(I) will try to address element DA(11), which won't exist and you will get a "Bad Subscript" error. The value or expression inside the brackets of an array variable, by the way, is called the Subscript. Another term for array variables is thus Subscripted variables.

Element zero

With Microsoft BASIC, the first array element is element zero. In other words, 'DIM A(12)' will set up an array with 13 elements numbered A(0) to A(12). Many people find element zero is a bit of a drag. After all, it's a lot more natural, when writing a routine to input 12 items of data into an array, to code:-

```
10 DIM DA(12) : FOR N = 1 TO 12 : INPUT
DA(N) : NEXT N
```

than it is to code:-

```
10 DIM DA(11) : FOR N = 0 TO 11 : INPUT
DA(N) : NEXT N
```

although both versions are valid and in fact the second will set up an array that occupies a little less of RAM storage. I usually shove the first item of data into element 1 and so on and use element zero for some piece of summary information regarding the data in the array, such as the total for all items or the number of items so far stored.

String arrays

Microsoft BASIC allows both String and Integer arrays. Again, each element can be manipulated in the same way as its first variable equivalent. Looking at String Arrays first, suppose you wanted to process the marks gained by 40 children in an exam, inputting for each child their name and mark and displaying their name, mark and divergence from the average mark. We can use two arrays in parallel, each 40 elements long (ignoring element zero as suggested above). One will be a String Array for the names and the other a numeric array for their marks. I call them parallel arrays because we must be careful to ensure that the marks for the child whose name is in element 6 of the String Array are placed in element 6 of the number array and so on.

Listing 5 shows a program which does what we require. Notice that String Arrays are named in exactly the same way as their simple variable equivalents with a dollar sign after the name before the first bracket of the element number or subscript. And in passing, note also that the DIM statement allows you to list a set of arrays separated by commas.

Integer arrays

If you have a lot of data to put in an array and it consists of whole numbers, Integers, in the range -32768 to 32767, an Integer Array can save you a great deal of RAM storage. A simple Integer variable provides no space saving over its 'real number' equivalent, but in array form the saving is three bytes per element. So that if your data requires a thousand elements and you can put it into an Integer Array, you will save 3000 bytes of RAM. You create an Integer Array and refer to it in just the same way as Real Number or String Arrays. Like the simple Integer variables, Integer Array names end with a '%' sign. For example:-

```
10 DIM DA%(1000)
20 FOR N = 1 TO 1000 : READ DA%(N)
        :NEXT N
30 etc
```

Arrays as tables of data

Suppose your firm manufacturers 5 products and you want to analyse the sales of these products for each quarter of the year just past. You could set up 5 arrays, one for each product. Perhaps you would name them P1, P2 etc. as shown in Diagram 1. The trouble with this approach is that to analyse the data you will need a separate piece of coding for each of the five arrays, because they each have a different name.

Conveniently for us, the designers of Microsoft BASIC took this into account, extending the notion of collecting related variables into a list array to collecting related lists into a two dimensional array. If you imagine the 5 arrays of diagram 1 being squashed up against each other to form a grid with rows and columns you get a pretty good image of a two dimensional array and how you might use it.

▶

Diagram 1

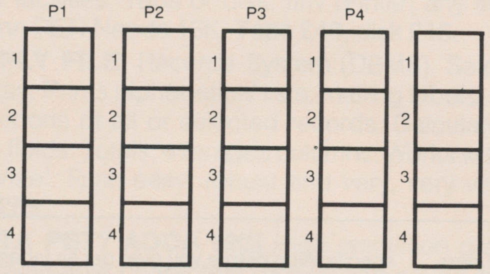
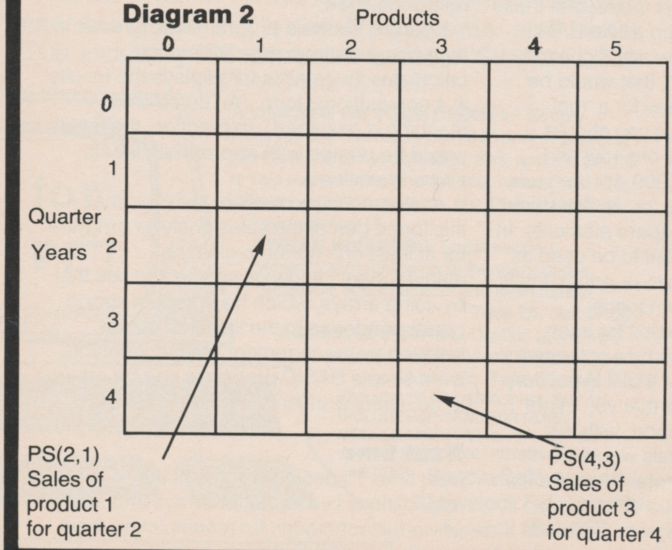


Diagram 2



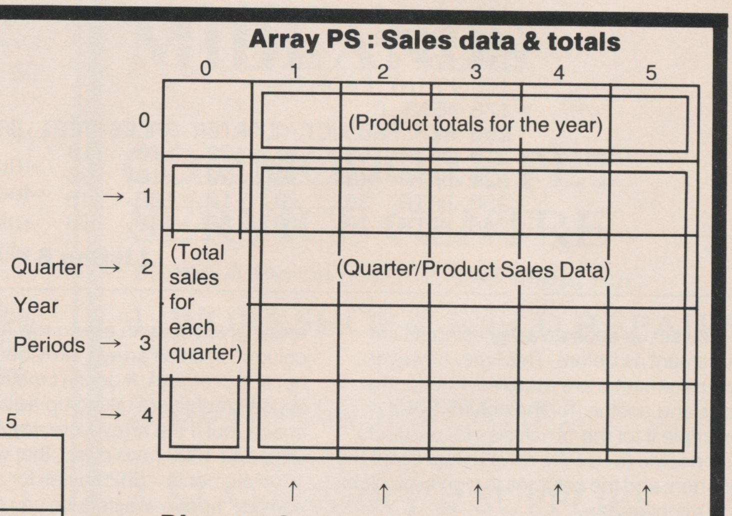

Array PS : Sales data & totals
0
1
2
3
4
5
(Product totals for the year)
(Total
sales
for
each
quarter)
(Quarter/Product Sales Data)
Quarter
Year
Periods
Products

Diagram 3

```
100  40   30   20   10   200
40   30   20   10   100  200
30   20   10   100  40   200
20   10   100  40   30   200
190  100  160  170  180
```

Diagram 4 – Screen display resulting from Program 6

```
10 T=0
20 INPUT "YEAR 1"; A : T=T+A
30 INPUT "YEAR 2"; B : T=T+B
40 INPUT "YEAR 3"; C : T=T+C
50 INPUT "YEAR 4"; D : T=T+D
60 INPUT "YEAR 5"; E : T=T+E
70 P=T/100 : PRINT A/P, B/P, C/P, D/P, E/P
```

Listing 1

```
10 T=0
20 FOR Y = 1 TO 10
30 PRINT "YEAR"; Y; : INPUT A
40 NEXT Y
50 P=T/100
60 NOW WHAT!!!
```

Listing 2

```
10 T=0 : N=10
20 FOR Y = 1 TO N
30 PRINT "YEAR"; Y; : INPUT YS(Y) : T=T+YS(Y)
40 NEXT Y : P=T/100
50 FOR Y = 1 TO N : PRINT "YEAR"; Y, YS(Y), "%AGE"; YS(Y)/P
60 NEXT Y
```

Listing 3

```
10 DIM MS(12) : T=0
20 FOR M = 1 TO 12
30 PRINT "MONTH"; M; : INPUT MS(M) : T=T+MS(M)
40 NEXT M : AV=T/12
50 PRINT "MONTH", "SALES", "DIVERGENCE"
60 FOR M = 1 TO 12
70 PRINT M, MS(M), MS(M)-AV
80 NEXT M
```

Listing 4

```
10 N=40 : DIM NA$(N), MK(N) : T=0
20 FOR M = 1 TO N
30 PRINT "NAME, MARK FOR STUDENT"; M; : INPUT NA$(M), MK(M) : T=T+MK(M)
40 NEXT M : AV=T/N
50 PRINT "STUDENT", "MARK", "DIVERGENCE"
60 FOR M = 1 TO N
70 PRINT NA$(M), MK(M), MK(M)-AV
80 NEXT M
```

Listing 5

```
10 DIM PS(4,5)
15 REM READ THE DATA, ACCUMULATE ROW TOTALS
20 FOR R = 1 TO 4 : PS(R,0)=0
30 FOR C = 1 TO 5
40 READ PS(R,C) : PS(R,0)=PS(R,0)+PS(R,C)
50 NEXT C,R
55 REM SCAN THE ARRAY TO ACCUMULATE COLUMN TOTALS
60 FOR C=1 TO 5 : PS(0,C)=0
70 FOR R=1 TO 4 : PS(0,C)=PS(0,C)+PS(R,C)
80 NEXT R,C
90 REM PRINT OUT THE ARRAY WITH TOTALS IN CONVENTIONAL PLACE
100 FOR R = 1 TO 4
110 FOR C = 1 TO 5
120 PRINT PS(R,C),
130 NEXT C : PRINT PS(R,0)
140 NEXT R
150 FOR C = 1 TO 5
160 PRINT PS(0,C),
170 NEXT C
200 REM PRODUCT/QUARTER SALES TEST DATA
210 DATA 100,  40,  30,  20,  10
220 DATA  40,  30,  20,  10, 100
230 DATA  30,  20,  10, 100,  40
240 DATA  20,  10, 100,  40,  30
```

Listing 6

◀

You set up such an array using a DIM statement as before. This time, however, two parameters are required, one for the rows and another for the columns. For example if for the "Analysis of 5 products" you decide to use the rows to represent the quarters and the columns to signify products, you might code:-

10 DIM PS(4,5)

In fact, you could put the columns first and the rows second ('DIM PS(5,4)'), so long as once having ruled which are quarters and which are products you stick to this rule for the rest of the program. My own convention is always Array(Row,Column). Diagram two shows an image of the array for the sales analysis program. I've annotated a couple of the elements so that you can see how to reference them in your coding.

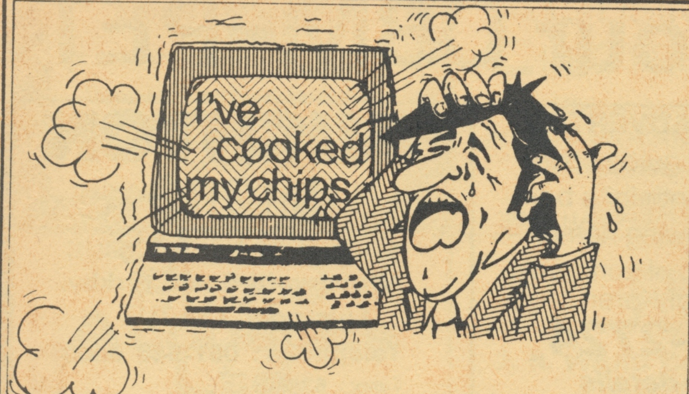
You will notice that in this example, as discussed above, I've ignored zero elements which, in the case of a two dimensional array, give you both a zero row and a zero column. In small arrays, provided RAM is not at a premium, it doesn't matter that these zero elements are taking up a little RAM space, but if the array were say 5 columns wide and 1000 rows deep, that would be 1004 elements – 5020 bytes for a 'real number' array – wasted, so you should either dimension the array one row and column shorter – e.g. DA(999,4) – and use the zero elements for data, or, as I've done here, find a use for these spare elements. In this case they are crying out to be used as row totals, corresponding to quarterly totals for all products and column totals, corresponding to yearly sales for each product. Diagram 3 shows how I planned to use the array. You will see that it is not very different from a data table that you might draw up to include in a report, with the exception that the row totals would be on the right and the column totals at the bottom. Incidently, a representation of the array, such as that shown in diagram 3 should form part of your program planning and specification before you ever get as far as the coding. It turns out to be a very useful reference chart.

Listing 6 shows a program which reads in the sales data from data statements, calculates the totals and displays the results in a conventional form. (An 80 column machine is assumed). In practice, the table would be printed with appropriate labels and underlinings.

A routine not much more involved than this forms part of the sales analysis program for at least one northern clothing manufacturer I know of, so you can see that by using arrays, which have such a strong correspondence to the lists and tables beloved by management and accountants, even simple BASIC programs can be made to do useful work and 'earn their living'.

Next time

Next time, I'll describe some of the applications I've found for arrays and some powerful techniques for manipulating them.



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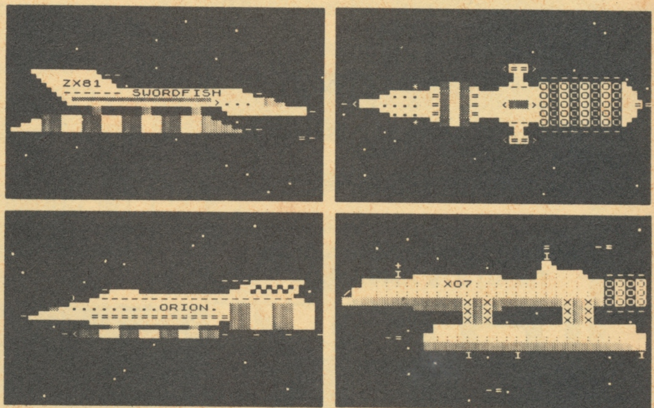

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47 ◀

CRAY I:

signer Seymour Cray himself stayed in the front room of his lovely home in handsome Chippewa Falls, Winsconsin, to sketch the follow-up machine. He likes walking in the woods.

From there he has lifted the veil on the Cray 2: it looks like a 26in. high oil drum because it's round (38in. in diameter). It will have four processors instead of one and will run between six and twelve times faster than the Cray 1.

As for memory capacity, we asked our US correspondent to take a look, and back came this report: "Ultra high-speed bipolar circuits with two nanosecond access times could provide an inner core to the existing main memory, while the new inexpensive low-speed memories would provide a gigamemory fringe of 32-64 megawords".

Won't it get a bit warm in the average office or living room? Well, yes it will. But Seymour Cray is nothing if not thoughtful: the Cray 2 will come complete with a tank of inert cooling fluid, the same stuff used for transfusions. You dunk the drum into the fluid and leave it there – and presto, no overheating problems.

Of course, if the thing breaks down you have to drain the tank to get at the duff circuit boards. So we wouldn't advise putting the Cray 2 anywhere where the odd splash or two will cause problems.

The Cray 2 should cost between $10 and $20 million and might well be ready in 1985.

Conclusions

If you want to do some old-style number crunching, then the Cray is for you. That means medium- to long-range weather forecasting, encapsulating nuclear fission, creating 3D images of the human heart, and suchlike. Other good applications we've heard of are geophysical research, seismic analysis and aircraft design.

Another use is in finding new prime numbers. A Cray employee called David Slowinski and a computer scientist in the States named Harry Nelson jointly used a Cray to find a prime number that is 13,395 digits long. This easily beats the previous record holder (a prime that is only 6,987 digits long).

Incidentally, if you want a standard of comparison, a billion billion is quite a large number: but it's only 19 digits long. A number 13,395 digits is estimated to be larger than the total number of atoms in the universe.

That deserves checking out. If you do decide on a Cray, a good first task for your new baby would be to count the total number of atoms in the universe.

But be warned: the extent of the available software is not terribly good. The Cray lacks some of the support to which you'll probablıy have become accustomed. You should not really consider the Cray 1 for strictly *personal* computing: and indeed you probably shouldn't contemplate it at all unless you have a sizable and highly qualified applications and systems programming department to call on.

If you have the tasks, though, and if you have the people, the Cray looks a good bet. Shop around and expect to pay between $5 and $16 million.

THIS DESIRABLE RESIDENCE

◀ 83

ing morning, noon and night, has very little to do with property directly and never sees the sea. He agreed readily that he's rejoined the rat-race.

Estate agency really seems to be a state of mind. They will doubtless change over the next few years; computers may even herald a revolution, along with the overdue changes in the law to eliminate the shysters. But the commercial instinct is something which you have or you don't. As David Perkins, who as a former president of the NAEE should know, puts it: "We're paid by one and employed to help another; we have responsibilities to one and an obligation to the other. As my old boss used to say, you have to have the nose to smell blood; computers are of little practical help here."

◀ 17

NOMINAL LEDGER

fully integrated suite on a microcomputer. The first one is the sheer lack of storage space to accommodate all the transactions which need to be properly recorded. The second problem concerns integrity of data. An erroneous entry by an inexperienced clerk on a stock ledger can mess up the entire nominal ledger in just one second.

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So should you buy a Nominal Ledger program for your micro?

The answer is Yes if you want monthly management accounts in order to keep on top of your business or impress the bank manager with your up-to-date accounts. Since monthly accounts can now be produced directly from the Trial Balance without any further operator intervention, anyone who can do accounts to Trial Balance can now produce a Consolidated Profit and Loss Account together with Consolidated Balance Sheet covering ten cost centres in less than half an hour.

If you are not particularly fussed about staying in business then don't waste your money – just book a seat at the local bankruptcy court.

Could you dispense with the services of your accountant if you purchased such a program? Well, yes, if you know how to make closing adjustments for items like depreciation and accruals – after all, anyone can prepare a set of accounts for submission to the Revenue. You don't have to be qualified in any way but it does help if you know what you're doing.

BEYOND THE FRINGE

◀ 61

fee for software products of other companies which it 'approves' of. Though the glory for this one has already been claimed by at least three other Commodore madonnas.

'It's only a silly slip of paper really,' he says, 'the whole intention was to make money.'

Rowe has invented something he calls invisible rock. Essentially it is a bundle of optical fibres which, he claims, can be barely seen. He finds it highly amusing to scare his friends with it. 'Oh yeah, some of them have nearly had heart failures,' he muses.

Which is quite something for someone who says he values nothing more in the world other than his health.

Rowe is typical of the seemingly endless stream of success kids cloned from the micro business, and they all wear their wealth on their car key fobs.

Take Ashley Ward, Managing Director of Intelligence UK and still the right side of 30. He has made a fortune out of a financial modelling package for company directors called MicroModeller.

He drives round in a brand new Mercedes. 'Actually,' he confides, 'I only have it to impress the bank manager.' But his grin suggests other, more hedonistic motives. Anyway since when has a bank manager, like other cold blooded reptiles, ever been impressed by such gross ostentation?

It must be said that the world would certainly be a different place without these microtechnocrats. A socket in the wall linked to a giant local government computer just does not seem the same as the ebulliant self-publicits who make their extremely large sums from the micro trade.

But at least we can rest content that it won't happen just yet – not next year anyway.

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Prom emulator	£295
Range of cross assemblers for most popular micros	£95
8048 BASIC compiler	£195

COMPLETE PET and HP-85 SYSTEMS

small systems engineering limited

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INSIDE TRADER

Poor Steve Jobs. Apple's founder generously offered to donate a free Apple III to each of the United States' 83,000 schools. Now everyone is *convinced* of the existence of a massive Common Market style mountain of unsold Apple IIIs.

Commodore's newly created 'Office of the President' must be a pretty crowded place. At the last count its inmates included such colourful figures as Jack Tramiel, Don Richard, Greg Pratt and Kit Spencer (remember him?). Everyone in fact except company President Jim Finke, who is described as 'working from home'. Suggestions that Mr Finke may soon be 'working from home' permanently are firmly dismissed.' However, I note that a Finke lookalike named (would you believe?) Fink has just been hired....

Improbably as it may sound, the Pope is on Prestel. Interested users (both of them) can contact him via page * 2222# between May 28th and June 2nd.

Now the folding computer. GRiD Systems of Mountain View (no, not the Apple mountain), California, are about to take the industry by storm with the first micro with an electro-luminescent display. 8086-based, the $8000 machine boasts 256K of memory plus another 256 of bubble memory in place of disks. Thanks to that screen display the GRiD can be folded down to only 15 by 11 by 2 inches!

Undue credance should not be given to the bizarre news reports emanating from this year's Hanover Trade Fair. Such was the state of inebriation of the press corps that several of the hacks were certified unfit to fly. Those that made it to Hanover appear to remember little of it, and have resorted (not for the first time) to imagination. Professional loyalty prohibits me from naming the guilty men. However, stories filed by 'Hooray Henry' Budgett (Computnig Toady), Duncan Snot (Popular Computing Weekly) and Martin 'Legless' Banks (Personal Computer World etc.) may be said to fall into the 'imaginative' category.

The Inside Trader Annual Cobblers Award goes to Apple for their recent 'Quarterly sales up 50%' press release, with consolation prizes to the entire computer press (this journal excluded) that reprinted it verbatim. Quarterly sales may well be up on a year ago – and so they should be – but the $13.8m figure quoted is actually $2m down on the previous quarter. Nice one Apple.

You will recall that there was somewhat less than met the eye in the Commodore's claim to have invented a 'universal' computer capable of running software written for any other micro. Now my good friend, Gregory Yob, has filed details of a Canadian outfit who have stuffed a 16-bit 68000 chip inside a VIC and can now emulate Apple, TRS-80 and sundry other machines. Clearly a case of truth being stranger than fiction.

Readers are invited to provide a plausible explanation of why, at the Sinclair Spectrum launch, Personal Computer World Editor, Petit Pierre Rodwell, was seen writing a cheque to Uncle Clive. Traditionally the greasy oncers flow in the other direction.

.1 divided by ten equals .001 – at least it does according to the IBM Personal Computer. "It's a bug in the BASIC interpreter ROM" admitted a spokesman for the jolly grey giant. So you'll be replacing the ROM? "Er, No...we are recommending customers not to divide .1 by ten..."

SEE VIC AT THE INTERNATIONAL
COMMODORE COMPUTER SHOW,
CUNARD HOTEL, HAMMERSMITH,
3rd-5th JUNE.

3rd June 12 noon-6pm. 4th June 10am-6pm.
5th June 10am-5pm.

VIC 20
commodore
FERGUSON TX
Movie Star

"Give me one good reason why I should choose a VIC 20 home computer."

1. VIC is outstanding value for money. No other colour home computer can give so much for under £200.

2. Total standard memory 25K made up of 20K ROM and 5K RAM.

3. Fully expandable to 27½K user RAM.

4. Microsoft Basic interpreter as standard.

5. Accessible machine language via plug-in cartridges.

6. Connects direct to monitor or standard television.

7. Full size typewriter style keyboard.

8. Full colour and sound.

9. All colours easily accessible.

10. 62 predefined graphic characters direct from the keyboard.

11. Full set of upper and lower case characters.

12. 256 displayable characters direct from the keyboard.

13. High resolution graphics capability via plug-in cartridges.

14. Programmable function keys can be used with plug-in cartridges.

15. Automatic repeat on cursor function keys.

16. User-definable input/output port.

17. Machine bus port for memory expansion and ROM software.

18. Standard interfaces for hardware peripherals.

19. VIC 20 is truly expandable into a highly sophisticated computer system with a comprehensive list of accessories (see panel below).

20. Full range of software for home, education, business and entertainment on disk, cassette and cartridge.

21. Books, manuals and learning aids from Teach Yourself Basic to the VIC programmers' reference guide (a must for advanced programmers).

22. Full support for VIC owners – their own magazine 'VIC Computing' as well as a national network of VIC user groups.

23. National dealer network providing full service and support to VIC owners.

24. Expertise and experience – Commodore are world leaders in microcomputer and silicon chip technology.

25. Commodore is the leading supplier of micro computers in the UK to business, schools, industry and the home.

26. VIC 20 is the best-selling colour home computer in the UK.

How many reasons was it you wanted?

Accessories include:

- Cassette tape unit.
- Single drive 5¼" floppy disk unit (170 K bytes capacity).
- 80-column dot matrix printer.
- 3K, 8K and 16K RAM expansion cartridges.
- Programming aid packs; machine code monitor cartridge, programmers' aid cartridge, high resolution graphics cartridge.
- Plug-in conversion box for a full 32K, 40-column x 24 lines VIC including Prestel compatability.
- RS 232C communication cartridge.
- Memory expansion board.
- IEEE/488 interface cartridge.
- Joysticks, light pens, paddles and motor controllers.

commodore

VIC 20

The best home computer in the world.

FOR MORE INFORMATION ON THE VIC 20, TELEPHONE OR WRITE TO: COMMODORE INFORMATION CENTRE,
675 AJAX AVENUE, SLOUGH, BERKSHIRE. TELEPHONE SLOUGH 79292.

Sinclair ZX81 Personal Comput
the heart of a system that grows with you.

ZX81
SHIFT
NEW
SAVE
RUN
LIST
PRINT

1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. Not surprisingly, over 50,000 were sold.

In March 1981, the Sinclair lead increased dramatically. For just £69.95 the Sinclair ZX81 offers even more advanced facilities at an even lower price. Initially, even we were surprised by the demand – over 50,000 in the first 3 months!

Today, the Sinclair ZX81 is the heart of a computer system. You can add 16-times more memory with the ZX RAM pack. The ZX Printer offers an unbeatable combination of performance and price. And the ZX Software library is growing every day.

Lower price: higher capability

With the ZX81, it's still very simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same micro-processor, but incorporates a new, more powerful 8K BASIC ROM – the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, *and* to drive the new ZX Printer.

sinclair
ZX81 BASIC PROGRAMMING

New BASIC manual

Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs.

Kit: £49.95

Higher specification, lower price – how's it done?

Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

New, improved specification

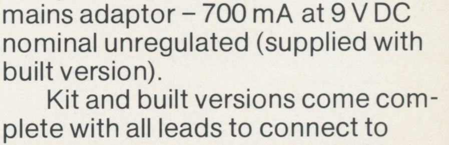
- Z80A micro-processor – new faster version of the famous Z80 chip, widely recognised as the best ever made.
- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.
- Unique syntax-check and report codes identify programming errors immediately.
- Full range of mathematical and scientific functions accurate to eight decimal places.
- Graph-drawing and animated-display facilities.
- Multi-dimensional string and numerical arrays.
- Up to 26 FOR/NEXT loops.
- Randomise function – useful for games as well as serious applications.
- Cassette LOAD and SAVE with named programs.
- 1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.
- Able to drive the new Sinclair printer.
- Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.

Built: £69.95

Kit or built – it's up to you!

You'll be surprised how easy the ZX81 kit is to build: just four chips to assemble (plus, of course the other discrete components) – a few hours' work with a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 700 mA at 9 V DC nominal unregulated (supplied with built version).

Kit and built versions come complete with all leads to connect to your TV (colour or black and white) and cassette recorder.



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sinclair
ZX 16K RAM
ZX PRINTER
10 FOR I=1 TO 22
20 PRINT "/"
30 NEXT I
40 PRINT AT 10,0;"----------"
50 FOR I=0 TO 63
60 PLOT I,22+20*SIN (I/32*PI)

Available now- the ZX Printer for only £59.95

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alphanumerics *and* highly sophisticated graphics.

A special feature is COPY, which prints out exactly what is on the whole TV screen without the need for further intructions.

At last you can have a hard copy of your program listings – particularly useful when writing or editing programs.

And of course you can print out your results for permanent records or sending to a friend.

Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your computer – using a stackable connector so you *can* plug in a RAM pack as well. A roll of paper (65 ft long x 4 in wide) is supplied, along with full instructions.

16K-byte RAM pack for massive add-on memory.

Designed as a complete module to fit your Sinclair ZX80 or ZX81, the RAM pack simply plugs into the existing expansion port at the rear of the computer to multiply your data/program storage by 16!

Use it for long and complex programs or as a personal database. Yet it costs as little as half the price of competitive additional memory.

With the RAM pack, you can also run some of the more sophisticated ZX Software – the Business & Household management systems for example.

How to order your ZX81

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day.

BY FREEPOST – use the no-stamp-needed coupon below. You can pay by cheque, postal order, Access, Barclaycard or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR. **Order**

Qty	Item	Code	Item price £	Total £
	Sinclair ZX81 Personal Computer kit(s). Price includes ZX81 BASIC manual, excludes mains adaptor.	12	49.95	
	Ready-assembled Sinclair ZX81 Personal Computer(s). Price includes ZX81 BASIC manual and mains adaptor.	11	69.95	
	Mains Adaptor(s) (700 mA at 9V DC nominal unregulated).	10	8.95	
	16K-BYTE RAM pack.	18	29.95	
	Sinclair ZX Printer.	27	59.95	
	8K BASIC ROM to fit ZX80.	17	19.95	
	Post and Packing.			2.95

☐ Please tick if you require a VAT receipt TOTAL £________

*I enclose a cheque/postal order payable to Sinclair Research Ltd, for £________

*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable.

Please print.

Name: Mr/Mrs/Miss

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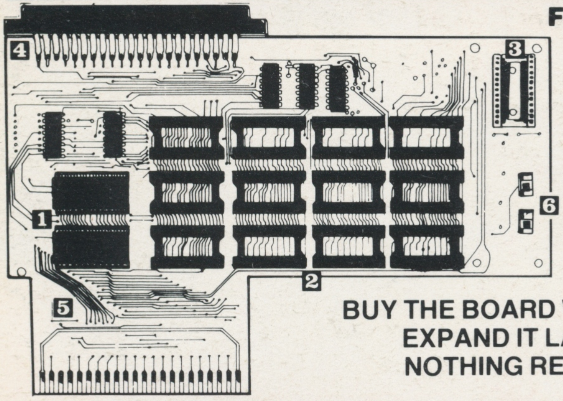
FREEPOST – no stamp needed. MPP 06

sinclair
ZX81

6 Kings Parade, Cambridge, Cambs., CB2 1SN.
Tel: (0276) 66104 & 21282.

THIS SHOULD BE THE ONLY MEMORY BOARD YOU WILL EVER NEED FOR YOUR VIC!

£49 +VAT



Features of the board include:

1. 3K Memory hi-resolution area
2. 24K Expansion area, just plug in the chips to expand memory!
3. Socket for VicKit or other roms
4. Memory port reproduced
5. High quality gold plated edge, plated thro' hole, glass fibre board
6. Switch to isolate 3K memory area

(Board shown with covers removed)

*Expandable board fully socketed with 3K RAM fitted.

NO NEED FOR A MOTHERBOARD OR EXPANSION CHASSIS

BUY THE BOARD WITH THE MEMORY YOU NEED NOW!
EXPAND IT LATER! ADD VICKIT OR VICKIT II
NOTHING REDUNDANT! NOTHING WASTED

VICKIT

£25

offers HELP to programmers

it also offers AUTO, DELETE, DUMP, FIND, HELP, OFF, RENUMBER, STEP, TRACE
Example:-

```
RUN

?DIVISION BY ZERO ERROR IN 500
READY.
HELP
 500 J = SQR(A*B/C)

READY
```

HELP How many times have you wanted to scream "HELP!" when your VIC couldn't interpret your program and all it would say was **?SYNTAX ERROR**? Fret no longer: Now just type in **HELP** The line on which the error occurs will be shown and the erroneous portion of the line will be indicated in reverse video on the screen. Truly a great help in any learning or school situation.

NOW AVAILABLE

VIC- Low cost 3k Memory

£25.99

Lowest Cost!
Compact Size!
Gives 6½k user Ram!
Allows high resolution graphics to be programmed!
Complete user instructions included!

VIC- Light Pen

OFFICIALLY APPROVED BY COMMODORE

This high quality light pen works in both normal and Hi-Res modes on the Vic allowing simple interaction with the Vic without keyboard entry. Easy to program and easy to use. e.g. Menu selection, Non-keyboard entry, Teaching, Games.
Feature: Touch sensitive "Enter" contacts to eliminate accidental entry.

£25.00

VICKIT II

£29

NEW

At last, Hi-resolution Graphics Made Easy
In addition to all the features of VICKIT, VICKIT II has.....

TEXT-	swap between the hi-resolution mode and normal text mode (TEXT automatically set on ERROR)
GRAPHICS-	
LINE-	for drawing lines and boxes (filled or unfilled)
CLEAR-	to clear the graphics screen
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PUT-	save and restore the contents of a rectangular area on the hi-res screen into and from an array
FILL-	fills an area on the screen
SET-	sets a point on the hi-res screen
POINT-	tests whether a point is set on the hi-res screen

VICKIT or VICKIT II plugs into ROM Switchboard or Stack Memory Expansion Board

SPECIAL INTRODUCTORY PRICE Only £64.00

Fully socketed board (with cover)
plus **3K hi-res area memory** plus **VICKIT**

plus £1.50 p&p or £5.00 Securicor
(Prices and p&p subject to VAT)

PRICES:-

BOARD with 3K	**£49.00**
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BOARD with 24K plus 3K	**£145.00**

SPECIAL
Add £15 plus VAT for VICKIT if ordered with any memory (Usually £25 plus VAT if supplied separately)

Additional Memory

8K (4 chips)	**£39.00**
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ASK YOUR LOCAL COMMODORE VIC DEALER FOR DETAILS OF STACKS VIC PERIPHERALS

THE PET & VIC GAZETTE

A special preview of the Third International Commodore Exhibition

NEW PETS & VICS
to be unveiled at Commodore Show

After a barrage of intense press speculation, contradictory reports and conflicting brand-names, Commodore has finally disclosed exactly which of its new range of computers are to be unveiled at the 3rd International Commodore Show at the Cunard Hotel in June.

* *The VIC 10* – otherwise, but incorrectly it seems, known as the Ultimax – WILL be on show.

* *The Commodore 64* WILL be on show.

* *The Commodore 500 and 700 series* – otherwise known, incorrectly it seems – as either the Commodore 2 or the 'Porsche PET' WILL be on show.

* *The VIC 40* WON'T be on show – and anyway it will probably be called the VIC 30!

Confused? Never mind. What this amounts to, when all the dust has settled, is a radical, comprehensive attack by Commodore on all areas of the micro market, from the top end of the business to the bottom end of latter-day toy town.

It is a vigorous attempt to maintain its 'brand-leading' status, as marketing manager John Baxter calls it, in the UK. Despite the incursions of Sinclair, and the likely incursions of IBM and all the others, Commodore is still doing well and hopes to continue to do so.

Only time will tell if its hopes are justified.

'The micro market is such a huge great market,' explains Baxter. 'Micros are now getting so powerful they're impinging on the mini computers in terms of power and capability.'

Against this background, Baxter claims that he 'welcomes' competitors. 'We expect to maintain our brand-leading position.' As an indication of Commodore's prosperity, he says that its turnover for this year is running at about £30 million. 'That is a growth of 111% on last year.'

'Our products are still the best selling machines for business and education,' he claims. 'We're even outselling Acorn to schools.'

At the same time, with the VIC 10, Commodore is hoping to cash in on the domestic games market which Sinclair has so successfully stitched up, closely followed by Atari *et al.*

The New Computers

The VIC 10 will have music synthesising functions, as well a colour graphics, and will sell at under £100. The music synthesiser has three voices, programmable tones, wave shaping and noise generator. Plug in cartridges, joysticks, paddles and light pen are additional features. It has 2K of RAM.

The Commodore 64 will be like a VIC 30 but with 64K of memory. There is some disagreement within Commodore, it seems, as to whether this fits in at the bottom end of the business market or at the top of the personal market. Baxter says the latter. It will sell at about £400.

This leaves the 500 and 700 series to attack the business market. At the lower end, the 500 series will come in three versions: 505 (64K); 510 (128K) and 520 (256K). The 505 will sell at about £695.

Baxter describes these as '40 column colour machines, with high-resolution graphics, built-in IEEE and RS232 and space for a second processor (!). It will have 10 function keys, a standard qwerty keyboard with a separate numeric keyboard.' In addition, the 500 range is expandable to 750K. Baxter conceives of it as replacing the 4000 range.

Right at the top comes the 700 series. This will come in two versions: the 710 (128K) and the 720 (256K). The former will sell at £995, the latter at £1595.

Baxter characterises these as 80 column business machines with separate keyboards, both with monitors with tilt and swivel screens. The 720 will have in-built dual disk drives. The 700 series will be expandable up to one megabyte, he says.

The title of 'Porsche-PET' is being discreetly back-peddled since Commodore dropped the original Porsche design.

Won't even Commodore be overstretching itself with such a wide range? Baxter thinks not: 'The Ultimax and the VIC are retail-type products, but for the business systems it's a totally different market. We have separate sales organisations to handle the different markets.

'There's absolutely no chance of *us* going bust.'

The VIC-20 will, of course, be on show, possibly (hint! hint!) at an even lower price than before....

NEW PET NETWORK, DISKS, & PRINTER

In the wake of its new range of computers, Commodore is about to launch some important new accessories.

Perhaps the most significant of these is Keynet, a local networking system which will link up any 3000, 4000 or 8032-type Commodore machines, as well as some 2000 series equipment.

'It is a major advance in local networking systems,' claims Commodore. 'The overall length of the network can be as much as 1.8 kilometers. Depending on distance, as many as 200 systems can be linked.'

Keynet is also cheap, easy to install, use and maintain, according to Commodore boffins.

And it will offer the advantages of existing network products. These are, of course, the ability to use and access common data bases and programs, as well as printers. The applications areas range from schools to warehouses.

One computer in the network is the 'master' and the others the 'slaves'. Any one of the compatible computers can be the master. The systems on the network do not all have to be of the same model. 'Keynet will run satisfactorily with any combination,' says Commodore.

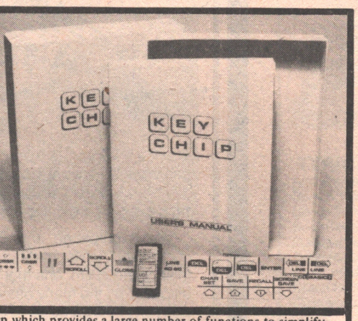
In addition, any Commodore mass storage device may be used with Keynet, including 4040, 8050, 8250 disk units, 9060, 9090, Shark 22 and Shark 30 hard disk units. Any other Commodore peripheral may be attached to the network.

The hardware consists of a printed circuit board for each computer in the network. There is some 'simple' software to open shared files. Other operations are handled by Eprom firmware. Speed will be 250 kilobaud. 'Existing software will only require minor changes to allow it to be run on the network,' claims Commodore. Security is also a feature it stresses.

Commodore 8300 Printer

This may well also appear at the Show. Commodore describes it as 'á letter quality daisy

See page 4, column 4



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FREE LEAFLET AVAILABLE

For 3000 and 4000 (9"screen) series PETs.

Fits in socket UD3 (others are available). Compatible with Toolkit & DOS.

KeyChip is a 4k chip which provides a large number of functions to simplify writing and debugging BASIC programs. The functions are activated by pressing the left shift key and one other key. It comes with professionally produced documentation & laminated labels for new functions of the top keys.

*LIST *scroll BASIC program up or down - one line at a time or continuously - starting at any line.*
These features available while scrolling program:
- *Reverse line numbers.*
- *Space between BASIC lines.*
- *Indent second line.*
- *New cursor-control chars.*
- *Jump to new program line.*
- *Variable speed scroll.*

*SCREENSAVE *store up to 10 different screen areas (or part of screen areas) & recall instantly + other features too numerous to mention.*

**Delete REMs and/or spaces from program.*
**Print contents of screen on printer (either char. set)*
**Regain control if cursor-move keys produce chars. on screen.*
**Move cursor up/down left/right in half-screen jumps.*
**Auto-repeat all/some keys - variable - no cursor flash when on etc.*
**Scroll screen up or down.*
**Open up blank line on screen or close up screen.*
**Change 80-char. line to two 40-char. lines & vice versa.*
**Delete screen above/below cursor, or from line to line.*
**Delete line right or left of cursor.*
**Delete BASIC line right/left of cursor (ignoring line numbers).*
**Instantly change to alternative character set.*
**Call up to 10 of your own machine code subroutines.*
**Instant in/out of programmed cursor mode.*

CRSR
CRSR
SCROLL
SCROLL
CLOSE
OPEN
LINE 40-80
DEL LINE BASIC
DEL LINE BASIC
ENTER
DEL
DEL
DEL
SCREEN SAVE
RECALL

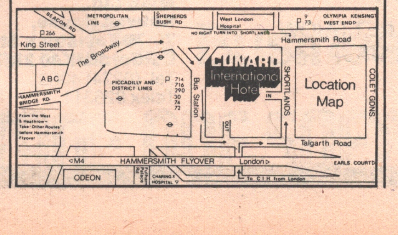
ABOUT THE SHOW

The third International Commodore Show will be held at the Cunard International Hotel, Hammersmith, London W.6. for three days commencing June 3rd.

Open hours are from midday until 6 p.m. on the Thursday; 10 a.m. until 6 p.m. on Friday, and 10 a.m. until 5 p.m. on Saturday. Admission is £1.

More than fifty companies will be exhibiting peripherals and software for the best-selling Commodore PET and VIC computers. Details on the following pages.

Advance tickets are available from the Commodore Information Centre at 675 Ajax Avenue, Trading Estate, Slough, Berks. Tel: Slough 79292.



THE PET COMPANION
PRINTOUT
All about Britain's best selling personal computers

"Every PET owner should read it"

Chuck Peddle, Inventor of the PET

"The PET Companion" is a fascinating collection of essential PET information from the pages of *Microcomputer Printout*. It contains **all** of the editorial from the 1979 & 1980 issues, including 105 PET programming hints and tips, 116 news reports, reviews of 54 peripherals ranging from light pens to printers and 27 major articles on PET programming. All of it written in straightforward English.

Some of the topics covered:

PROGRAMMING THE PET
Double Density Plotting
Modular Programming
Programming Style
Graphics
Subroutines
Sorting Out Sorts
Tokens
The Game of LIFE
Tommy's Tips
ROM Addresses

THE SOFTWARE
Business Software Survey
Cosmic Invaders
Superchip
PETAID Do-It-Yourself Database
What's Wrong with WORDPRO?
Screen Display Aids
Keyboard Tutor
Photography Course
Who Do You Want To Be?: Fantasy Games
Commodore's Assembler Development System
Programming Aids & Utilities Survey
PET Games

HARDWARE REPORTS
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Hardware Repeat Key
High Resolution Graphics
The Commodore Printer
How the Keyboard Works
AIM161 A to D Convertor
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PET's Video Logic
Colour for PET: The Chromadaptor

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PET in Education
PET Show Report
The Jim Butterfield Seminar
Hanover Fair Report
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A Visit to the Commodore

plus news, letters, gossip and regular columns by leading PET experts.

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HOW IT ALL BEGAN.....

Commodore promises that this will be 'the biggest and best' Commodore Show yet.

It is expecting over 20,000 visitors to flock to the Cunard Hotel, Hammersmith, London, between the 3rd and 5th of June, compared to 11,500 last year.

There will be over 100 exhibitors, all with products or systems that lock into the now considerable Commodore empire. This represents a 20%–30% increase on last year's user base.

In all, the exhibition will occupy over 18,000 square feet, a large part of which Commodore has given over to an Information Technology 82 stand-cum-massive-complex. This will include a video theatre, with non-stop films about the growing influence of the microcomputer in all walks of life.

Commodore will run specialist seminars throughout the show – 'designed to introduce businessmen and other professional people to the world of microcomputers.'

" PET SHOW "
Akwil
Akwil
Motion Message System

Eccentric VIP

Jim Butterfield, well-known Commodore guru and eccentric, will be among the very-important-persons on show. One of the foremost authorities on the PET, he is always good for a few stumulating views.

This is the third Commodore Show, more affectionately known in previous years as the PET Show. Perhaps it is significant that this title is not in favour these days. The need to create a nice friendly atmosphere that inspired the name 'PET' in 1978 has now given way to the need for a more serious image.

As the years go by, and the micro user base becomes larger and more discerning, the emphasis has shifted from assuaging fears about computers in general to assuaging fears that they will do, in fact, what the makers claim.

It's getting harder to pull the wool over users eyes, and the micro companies have responded – Commodore included – by a more hard-headed, business image.

This may be a shame, at least as far as the show goes. The 'good fun' image which it established two years ago at the Cafe Royal may now give way to a much bigger, altogether more serious enterprise.

This special preview of the 3rd International Commodore Show was edited by ***Chris Barnard,*** *and published by Printout Publications, P.O. Box 2, Goring, Reading RG8 9LN, telephone 049162 – 798.*

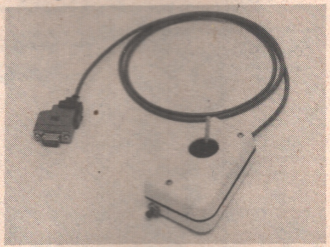
VIC GOODIES AT LOW COST

Stack Computers will be showing their latest range of what they call 'flexible, low-cost add-ons' for the VIC 20.

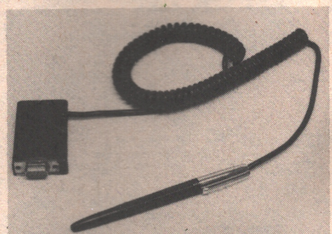
For example, *'Storeboard'.* This is a remarkable new 'start-small (and cheap), grow-big-later' concept for memory expansion on the VIC.

Stack claims that it has already enjoyed large success with this product. 'The unit provides for continued expansion up to VIC's full capacity. All programming and graphics are made to be easily accessible, whilst still not tieing up the memory port.'

Stack reckon their success is due to their fleet-footedness in jumping into the VIC market before their competitors with 20 add-on items, a range which they are constantly adding to.



'We've outpaced and outperformed our competitors whilst undercutting in price,' is their grand claim, one that doubtless will be disputed by the many other firms seeking to cling on to the same bandwagon.



On show for the first time will be some new extensions to the list, promises Stack, 'including a multi-slot expansion for only £30.' Stack will be demonstrating and explaining its products at the show, with a special come-on of 'show-only' prices as well as the usual alcoholic blandishments, no doubt.

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Along with these high technological advances has followed the development of sophisticated programs for accounting and other procedures, designed in such a way that inexperienced people can operate the systems with a minimum of training. Thus, with the combination of the right program and the right computer system, every small to medium business can benefit enormously with its very own computer at a surprisingly low cost.

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STOCK UNDER CONTROL

When hard times like these are upon us, it is vital for small companies that they do not waste a penny more than they need to in holding stock. Efficient monitoring of stock levels can mean the difference between survival and bankruptcy – at least, that's how the story goes.

To this end, purveyors of business systems, Dataview, will be showing its stock management system 'Stockaid'.

Stockaid handles normal stock recording features, such as issues, ordering, deliveries, reservations, returned goods, adding or deleting items, amending existing records and stock enquiry.

Using a Commodore 8050 disk-drive, 3800 stock items can be handled with no exchange of disk. Using a Mator Shark over 30,000 items can be handled, says Dataview.

For management, this package provides various facilities, including automatic calculation of re-order levels and economic order quantities, slow moving item analysis, outstanding orders report and other kinds of analysis.

BIGGER, BETTER RECORD SYSTEM

Compsoft will be showing its new version of *DMS*, a records management system which it claims is 'the most popular in the UK'.

The new release is a complete re-write, says Compsoft, with its own mini wordprocessor. It is available only for CBM 8032 or 8096 systems.

'More detailed records can be kept,' says Compsoft, 'selection and sorting is more powerful, and there is a full-blown report generator. Other new facilities include a proper date program, easier calculation routines, multiple files per disk, and free text searching.

'The manual now has a training guide. Training can also be supplemented at Compsoft's training centre near Guildford.'

The mini word-processor is revolutionary, according to Compsoft. 'Simple to learn and operate, it will deal with mailing more efficiently than ever before. Now users can write the standard letters within *DMS*, select the records to merge with them, and within minutes have set up a speedy and clever mailing operation.

'This is ideal for anyone wishing to do client or customer mailing, renewal or subscription reminders, recall patients, make announcements and so on.'

The recommended retail price will be £290. Compsoft stresses the user friendliness of *DMS*. It has achieved over 3000 installations to date, has a user club, and is available in Swedish and German translations.

"IT WILL INTERFACE TO ANYTHING"

'It's ultra-safe.'

That's the message that John Chew wants to get across about Kingston Computer's new interface unit called 'Dialogue'.

'Dialogue' will be launched, together with three other products, at the show.

Chew makes a multiplicity of claims about this unit. 'It's the first split-speed interface that we know of,' he says, meaning that it can talk at one speed and listen at another. 'It will interface a PET to anything,' he adds, either to peripherals or machine to machine. This includes Centronics equipment and RS232C emulation with opto isolation.

Chew says he has been working with British Telecom to get this product up to required standards.

For users, it means the possibility of going into robotics, using a computer to drive and manipulate mains motors. It could also provide a direct Telex link-up.

These, together with echo capability for error detection for communications tasks, are only a selection of functions which Chew claims for the Dialogue 'all in one box'. It will sell at £199.95.

Other products North Yorkshire-based Kingston Computers will be launching at the show will be 'Secure', an encryption system for 'everyman', and two remote control mains controlling devices called 'Mate' and 'Team'.

COMPUTERIZED ADMINISTRATOR FOR BUSINESS

Simultaneous to the PET Show is the announcement by Stage One of *Administrator II*, an extension of its 'internationally accepted and highly praised' commercial applications generator.

The *Administrator II* boasts new facilities, allowing system changes after the application has been set up. Also, large volumes of information can be put into a 'daily journal file' for subsequent printing and merging with multiple volumes of master files.

Also new is the facility to amend transactional data.

The *Administrator,* says Stage One, 'allows the average person to set up their own applications.' The variety of possible applications is multifarious, covering a range of specific professions, like travel agents, doctors, estate agents as well as general applications such as invoicing, mailing, stock control, and many more.

'The unique facility of the *Administrator,*' claims Stage One, 'is its ability to store unlimited amounts of transaction information.'

Also on show will be versions of *Administrator* for the CBM 8096 and for the Mator Shark, 'providing large systems capability at microcomputer prices. The *Administrator* provides for a combination of data and word processing, together with facilities such as "wild card" searching of master and text records.'

Two new *Administrator* systems will be on show. *File Administrator* is a simplified filing system for single record file structures. The *Administrator Accounting System* 'provides full open item accounting facilities for the small business'. This system offers a range of invoicing routines and accounting up to trial balance.

Stage One reports 700 sales of the *Administrator* in six months. 'The *Administrator* is a tried-and-tested general purpose range of programs which are now working in business and commerce throughout the world,' they say.

It is a concept which gives the user the opportunity to tailor his own system to his own requirements and is one of a family of highly compatible software products.'

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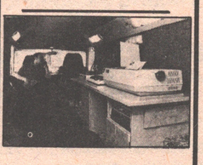

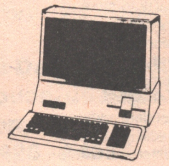

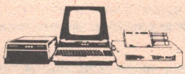

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NEW SILICON OFFICE ALL-IN-ONE BUSINESS PROGRAM

Showing Silicon Office: Bristol Software's Michael Whitehead

The 1000th *Silicon Office* installation – it sounded like an ideal opportunity for Bristol Software Factory to celebrate the success of its product, which it hoped would coincide with the Commodore Show. All kinds of publicity were prepared to celebrate the event.

Unfortunately, the product has been *too* successful, apparently – so much so that its publicists were embarrassed to find that the 1000th installation had already occurred – several weeks ago!

Never mind, the *Silicon Office* – which has only been around since October 1981 – will be on show, together with a very futuristic environment.

The *Silicon Office* is undoubtedly 'the success story of the year'. At least, that's what everybody says and the sales seem to prove it. In the words of Bristol Software's Mike McDonald *Silicon Office* is: 'The integration of a database management system with that of a word processing system, together with communications.'

'The end user can set up his own application system without the need for a programmer or analyst.'

'It's the largest single machine code program on Commodore,' says McDonald, creating what he calls an 'operating environment'. 'It is as radical as *VisiCalc* was in its day,' he claims. 'It is the leading Commodore software product.'

Silicon Office runs exlusively on the Commodore 8096. McDonald is hoping to unveil *'Silicon Office 2'* at the show, in line with the announcement of Commodore's 500 and 700 series of business machines.

NEW PET NETWORK, DISKS, & PRINTER

wheel printer, based on the Diablo 630.'

Whereas the Diablo is fitted as standard with an RS232C interface, the 8300P will have an IEEE 488 interface. 'Initially, these will be external add-on units but eventually they will be built into the units.'

Bi-directional printing at 40 characters per second is also a feature, with a selection of 10, 12 and 15 cpi metal and plastic print wheels. A selection of switch settings is available. The unit comes as standard with a friction feed, but there is a tractor feed mechanism available.

New disk-drives

Two new hard disk drives are about to break the surface, the 9060 (5Mb) and the 9090 (7.5Mb).

Commodore describes them thus: 'Both units are intelligent IEEE 488 devices using Tandon hard disk mechanisms. The operation is transparent to any user familiar with existing 8050 or 4040 floppy units, with the additional features of large capacity and unlimited relative file size.'

Also shortly to be seen is the Commodore 8250 dual disk drive. Says Commodore: 'Looking externally and internally very similar to the original 8050 Micropolis drives, the 8250 offers twice the capacity of the 8050 on double sided, double density 5¼" diskettes.

'The organisation of the diskette surface of the 8250 means that tracks 0 to 77 are on the usual surface tracks, 78 to 154 on the second surface, the switching between the surfaces being transparent to the user.'

The relative record file size has been expanded to 1MByte. The record size is unaltered at 254 bytes. 'Relative record files cannot be directly interchanged between the 8250 and 8050 and vice versa, however, a program will be supplied to facilitate this operation.'

The unit has a built-in IEEE 488 interface.

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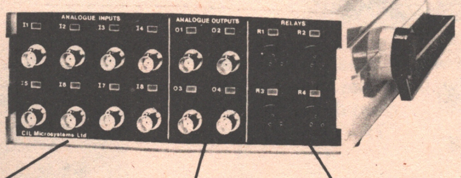

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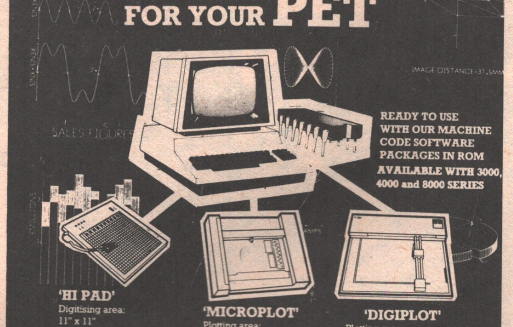

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'MICROPLOT'
Plotting area:
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Plotting speeds:
400 mm/sec Pen up,
70 mm/sec Pen down, variable
Resolution: ±0.05 mm
Interface: IEEE, Address 7 (can be changed)
Character set: Alphanumeric, £, π, √
Character size: 5mm → 30mm height
Axis drawing: Command for size and number of segments
Rotation: 0°, 90°, 180°, 270°
Basic Command set: 15

'DIGIPLOT'
Plotting area:
360mm(X) x 260mm(Y),A3
Plotting speed: 50 mm/sec
Resolution: 0.1mm
Interface: User Port (can be IEEE)
Character set: 96 ASCII characters, inc. Upper/Lower Case
Scaling: 16 sizes for printing characters
Axis drawing: Command for size and number of segments
Rotation: Rotate command for printing characters
Basic Command Set: 14
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ALL LEDGERS INTEGRATED

Office Mate, the office accounting system developed by Microcomputer Centre, has had a pretty low-key life so far.

It took four years to develop, has only been around for a matter of months, and so far 'not many people know about it,' says the Centre's Jim Thompson.

Office Mate was only properly launched earlier this year, and the latest version of it will be on full view at the show. Despite its lack of visibility, Thompson claims that sales have so far been excellent.

'It's a totally interactive package,' he says, meaning that purchase ledger, nominal ledger, payroll – *all* accounting functions – are available in one integrated package. 'There's no double entry needed,' says Thompson. In all, *Office Mate* contains a total of 40 different programs. This is not the case with his competitors, he claims.

Office Mate in its complete form costs £2,100, but its modular structure means that it can be built up in parts costing less.

'It can also be customised to suit clients' different operating structures,' says Thompson. 'The variations are all in the program – it's just a case of setting it up.'

Office Mate runs on the 8032 and 8096 machines. It can operate as a single or multi-terminal system. Full back-up is provided by the company, says Thompson. It is also distributed abroad, to France and Germany.

INVESTMENT ADVICE FROM PET

London-based Micro Facilities are in the last throes of putting together a new portfolio management package for stockbrokers.

The product will be demonstrated at the show but Managing Director Derek Randall says that it may be four months before the actual launch. In the meantime, customer enquiries are welcome.

The package will run on the 8000 series PETs and is the first of its kind to run on a micro that Randall knows of in this country.

Its development was due largely to enquiries from potential customers – 150 in all. 'We wrote a program for a stockbroker,' says Randall, 'and it was he who suggested we might make a package.'

The program will hold stock valuations, historical records of clients, written valuations and other functions to do with stock broking. It could be linked up to a Wordcraft word processing system; it will also be connectable to a mainframe computer via telephone link, in order to access current share prices.

It will cost about £650.

NEW PET PROGRAM SIMULATES MACHINE TOOLS

M42
commodore CBM dual drive floppy disk
commodore CBM computer

Toolpath Simulator based on PET

Training machine tool programmers can be an expensive business if the student gets his sums wrong and damages the machine he is using by a wrong movement of the cutting tool.

In response to this, Taylor-Wilson Systems of Solihull have developed a simulator which runs on a PET. This new product will be on show.

This is another example of the increasing use to which a microcomputer – once dubbed as a mere hobbyists plaything – is being put in the hard, pratical world of engineering and manufacture.

Toolpath, as the product is called, is only a fraction of the cost of a production machine, say Taylor-Wilson, at the same time eliminating the risk of costly damage by trainee error.

The trainee uses a high resolution VDU to trace how the tool moves and shapes the metal, as the computer progresses through the program block by block. 'This allows the program to be checked for errors or unnecessary tool movements without endangering the actual tools,' Taylor-Wilson add.

'At any point in the program a section through the billet can be printed in high-resolution enabling a printed record to be kept of each stage.'

At the show will be the Mark II version of *Toolpath*. 'This is much more flexible in its capabilities, with a more extensive tool library.' A complete system costs about £5,000 compared to over £20,000 for a real machine lathe.

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SimpliCalc makes the "what if" exercise available on all sizes of CBM. On a 32k it provides a much larger useable matrix than any similar program: on an 8k it provides enough space to analyse a capital purchase or personal tax computation.

SimpliCalc is freeform. Its uses are many. For instance, it's been used calculating chemical weights, projecting profits by product group, and costing out salary reviews. Be inventive.

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We are serious when we say you should see more than one. That way you are more likely to find the one most suited to your needs. However good PAYROLL PLUS is, there are certain things it won't do that other payrolls will — and vice versa.

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SUPERIOR PROGRAMS FOR THE
CBM/PET MICROCOMPUTER

BEST U.S. VIC SOFTWARE ON SHOW

Reading-based Audiogenic will be showing off 30 VIC programs which it has imported from the US, from companies such as United Microware, The Code Works, Human Engineered Software (anything to do with cloning?) and Creative Software.

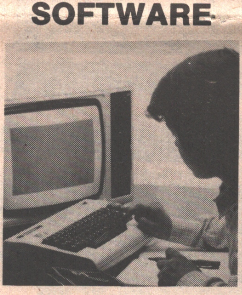
Audiogenic will also be showing off David Linberg, technical director of United Microware.

Also for the VIC, Audiogenic's range of expansion chassis will be on show, together with a complete word processing package and a 'stringy-floppy' – a cassette that looks like a disk-drive. A programmer's tool kit with 3K of expansion RAM, will also be demonstrated.

'Staff will be on hand to answer complaints,' jokes Managing Director Martin Maynard – at least I assume he's joking. Either that, or he's honest.

'Anyone who wants a punch-up, come and see Anne.' About that, he is deadly serious.

VIC EDUCATIONAL SOFTWARE



Adda Computers, who run the VIC Centre, will be launching about six new titles in educational software.

Adda will be working in collaboration with a software house to produce these titles, which will be for school or home education, for age groups between five and 15, and will be on maths and languages, among others.

'They will be of high quality,' claims spokesman Peter Raybaud. 'A lot of thought has gone behind them.'

Delays in appearance of the VIC has led to delays in the software, says Raybaud, but he believes that home computers are about to take off in a big way.

This educational slant will add depth to Adda's range, which so far has concentrated on games. As well as its retail outlet, Adda also runs a mail order system.

Wego Computers Ltd

BackPack – A standby power supply that fits internally within the PET and Disk Drive. It gives at least 15 minutes to close the system down in an orderly fashion.
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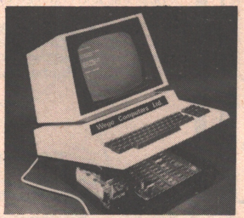

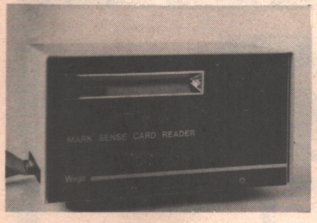

The Card Reader is now available with an optical read head, which can also read punch cards.
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SEQUENTIAL SWITCHING UNIT
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The Sequential Switching Unit for powering up and down various devices in the correct sequence.
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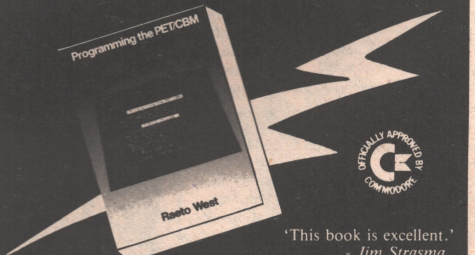
NEW

Programming the PET/CBM



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PET/CBM Personal Computer Guide 2nd edition C. Donahue and J. Enger
Everything you wanted to know about your PET but didn't know *where* to ask. This book covers every aspect of the PET, from where the 'on' switch is, to the assembly language subroutine.
93198855 1 **£10.95**

PET and the IEEE 488 Bus (GPIB) E. Fisher and C.W. Jensen
This is the only complete guide for those who want to know more about interfacing PET to GPIB. It begins with a detailed description of the GPIB and its lines and signals, and goes on to describe interfacing the commodore PET computer to any I/0 device.
93198831 4 **£11.50**

Some Common BASIC Programs L. Poole, M. Borchers and C. Donahue
Both a time and money saving guide, this book provides 76 programs that have been written in Commodore BASIC to run on your PET and CBM computers. The programs cover a wide variety of personal finance, mathematical, statistical and business problems, and each one is presented with complete source listings, a sample run, operating instructions and programming options.
93198840 3 **£10.95**

6502 Assembly Language Programming L. Leventhal
Increase the capabilities and performance of your PET (and other 6502-based computers) by learning to program in assembly language! This book covers the fundamental concepts of assembly language programming, and describes the finer points of programming the 6502.
93198827 6 **£11.95**

Available from your local bookshop, computer store, or direct from the publisher:-

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Classic Offices, Hendon Central, London N.W.4.
Tel: 01-202 2726/9630

MULTI-PURPOSE INTERFACE FOR PET

3D Digital Design and Development has got so much to show that it will be occupying two stands this year.

New features will be in evidence on its *Inlab* product – a mutli-channel, multi-purpose interface system for the PET. *Inlab* allows monitoring of up to 128 analog channels, control of up to 128 relays, as well as generating 64 analog voltages independently and looking at 96 BCD digits.

With new features, the system now boasts such functions as a fully programmable real-time clock and calendar, universal eight decades frequency counter, time interval, frequency ratio, event counter, multi-channel thermo-couple amplifier with cold junction compensation in hardware, multi-channel intelligent stepper-motor controller, and 14 bit analogue-to-digital converter with programmable amplifier.

Inlab developed, says 3D, as a natural growth from its standard IEEE units. These units they still make separately but now they can be bought collectively on a modular basis, mounted in a 19" rack with controller card – that is *Inlab*.

Also new is an identical device to run on the VIC, allowing the remote control and monitoring of instruments and devices up to half a kilometer.

Another new device for the integration of signals from medical analysis is DMA – I 82. This is characterised as an integrator and peak detector, useful in cromatography. It uses a 4022 PET printer and has its own programmable gain amplifier with 12bit a/d converter. 'With PET, it is cheaper and more flexible than any system on the market,' claims 3D. 'On a PET it is unique.'

PINEWOOD COMPUTERS
announce
the launch of
the 64K EXPANSION BOARD for 8032 PETs

Yes. We couldn't wait for the others so we have launched our own 64K Memory Expansion board to upgrade the 8032 PET to a full 96K. Silicon Office and other 96K programs are now possible on a 32K PET with our board. It is of U.K. design and manufacture and comes complete with full fitting instructions.

Our price **£350**

Other new PET enhancements include:
EPSON/PET INTERFACE CARD **RRP £90**
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VP012	**ViCalc** . . . Turns the VIC into an easy to use programmable calculator. Ten memories are displayed on the screen along with four working registers. Using single keystrokes all normal addition, multiplication etc. and scientific functions may be undertaken as well as compound interest and percentage. Precision may be set to round up the last digit from 0 to 9 decimal places. **PRICE £8.99.**
VP016	**A-MAZ-ING** . . . Needs 3K expansion. Fast action gobbler game - eat the dots and avoid the nasty ghosts. You can eat the ghosts when they change colour. **PRICE £6.99.**
VP023	**MASTERWITS** . . . Try to deduce the pattern of four markers from the six colours at your disposal, while Masterwits gives you the clues you need. Rumour has it that seven tries is average!? **PRICE £6.99.**
VP024	**KIDDIE CHECKERS** . . . Teaches small children to play the game of draughts. Only looks one move ahead. **PRICE £6.99.**
VP025	**WALL STREET** . . . The stock market comes to life. Follow the market's daily rise and fall with cash, shares and hope. Sharp trading will win. **PRICE £6.99.**
VP026	**ALIEN BLITZ** . . . How good are you at blasting aliens from the sky? Find out on the superhuman ninth level. **PRICE £7.99.**
VP029	**SKYMATH** . . . Needs 3K expansion. Specially for young children! Addition and subtraction problems set in a highly entertaining audio-visual presentation. The sound and visuals provide the incentive to learn. **PRICE £6.99.**
VP030	**SPACE DIVISION** (Level 1) . . . Needs 3K expansion. Another one for kids! This program sets division questions in the context of a rocket countdown. As the questions are answered correctly, the rocket prepares for blast off, until finally the child is rewarded by seeing the rocket take off. **PRICE £6.99.**
VP032	**INVADER FALL** . . . Another variation on the Invader theme. This timethe unpredictable aliens fall from the sky at different points across the screen. You must shoot them before they touch ground. Accuracy and quick reflexes essential! **PRICE £6.99.**
VP033	**THE ALIEN** . . . Needs 3K expansion. You are the Alien. You have landed in a maze inhabited by unfriendly creatures. You must trap the creatures in your inflatable traps to avoid being eaten by them. A totally original game concept! **PRICE £7.99.**
VP034	**STAR WARS** . . . A game for all you budding Skywalkers! You are the space gunner fighting off the interceptor ships of the evil Empire. **PRICE £6.99.**
	CARTRIDGE PACKS
VP014	**SPIDERS OF MARS** . . . The most incredible VIC game yet! You are a trapped fly and you must shoot your way across Mars avoiding the dreaded Spiders and the other flying creatures. With classical music! **PRICE £24.99.**
	INTRODUCING THE NEW RANGE OF VIC PROGRAMS FROM CREATIVE SOFTWARE OF CALIFORNIA
VP044	**HANGMAN-HANGMATH** . . . HANGMAN . . . As it suggests. You must guess the word before you get hung from the gallows. HANGMATH . . . The same except that you have to solve a mathematical problem. **PRICE £7.99.**
VP045	**MATH HURDLER-MONSTER MAZE** . . . MATH HURDLER . . . Is designed to teach basic maths. If you answer wrongly the hurdler crashes. MONSTER-MAZE . . . You are in a maze and have to escape by the exit without crashing into walls or being caught by the monster. **PRICE £7.99.**
VP046	**SEAWOLF-BOUNCE OUT-VIC TRAP** . . . SEAWOLF . . . You are a submarine and you have to sink as many enemy ships as possible in 60 seconds. BOUNCE-OUT . . . Full colour 'Breakout' type game. Keep the ball in play while breaking down the wall. VIC TRAP . . . A battle between you and the VIC. Try to cross the screen whilst enticing the VIC to cross your path to score extra points. **PRICE £8.99**
VP047	**CODE MAKER-CODE BREAKER** . . . CODE BREAKER . . . The VIC has to guess what code or pattern you have made. CODE MAKER . . . You have to guess the code or pattern that the VIC has produced. You are rewarded with black or white tokens as to the number of guesses you have made. **PRICE £7.99.**

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PROJECT PLANNER WORKS UNDER WATER

Claremont Controls are getting onto the *Silicon Office* bandwagon – one of the success stories of the year.

Claremonth makes a project planning and management package called *Hornet*, which will now be on show with its new *Silicon Office* link. 'Taking two of the most powerful programs available on Commodore computers, this link integrates the project and your administration, says Roy Stephenson, marketing manager of Claremont.

'Each program is powerful in its own right: the fusion of the two has virtually unequalled potential,' he claims.

He goes on to say: 'Since the last Commodore Show, *Hornet* has been accepted as the best project planning system on a microcomputer. Clarity and ease of use have led many users to choose it in preference to their existing large installations.

'*Hornet* produces clear and comprehensive reports about data schedules and resources, including bar charts and histograms.'

Among *Hornet's* clients are refitters of nuclear submarines, a topical note, if unfortunately so.

TWELVE MEGABYTE HARD DISK FOR PET

Small Systems Engineering of London will be showing off its new storage product, a mini-Winchester unit for the PET, called the MW-1000.

'This is a compact desk-top unit that just plugs into the PET, giving you up to 12Mb of hard disk storage under CP/M, or PET DOS, or both.'

The variations are as follows: the whole disk under CP/M (plus 60K of RAM and Z80); the whole disk under PET DOS; half of the disk under PET DOS and half under CP/M.

'No changes to the PET or ROMs are required, says Small Systems; all these options are available 'at the flick of a switch'. Retail prices range from £2538 for the 3MB, to £3360 for 12MB.

PROGRAMMING TOOL FOR BEGINNERS

Child's play? Intex Datalog's PET compiler.

Intex Datalog will be showing two products that are so new they haven't though of names for them.

Hot from the development stage is an 8096 version of its old PC BASIC compiler. 'It's a fully optimising compiler,' says an Intex spokesman.

'It can either compile into compressed BASIC code in order to reduce the size of programs, or else compile into pure machine code, which means maximum running speed.

'The user has the choice of compiling parts of a program into one or the other. In other words, he has the choice between speed and program size.'

Also new, 'fully de-bugged and tested', is a programming tool 'with lots of useful routines, such as input, number formatting, sort, search, and cursor control among others.'

'It enables someone not fully conversant with BASIC or machine code to write programs to a professional standard,' claims Intex.

This preview of the 3rd International Commodore Show was edited by Chris Barnard.

NOW NETWORKS OF VICS!

A new networking product for the VIC is to be seen for the first time at the show.

Following in the footsteps of the *Petswitch* comes the *'Vicswitch'* from Woking-based Datalect Computers. This will enable up to 15 VICs to be linked together, sharing printer and disk drive resources.

It consists of a mother unit, costing about £50, and daughter units costing about £30. At the centre of the network is a small box which plugs into the back of a VIC; from there on the other VICs are looped together in a ring-main type principle.

'There's nothing like this around,' enthuses Peter Watts of Datalect. He sees *Vicswitch* being particularly popular in schools and other educational establishments, where the VIC is currently selling very well and where many terminals are often required.

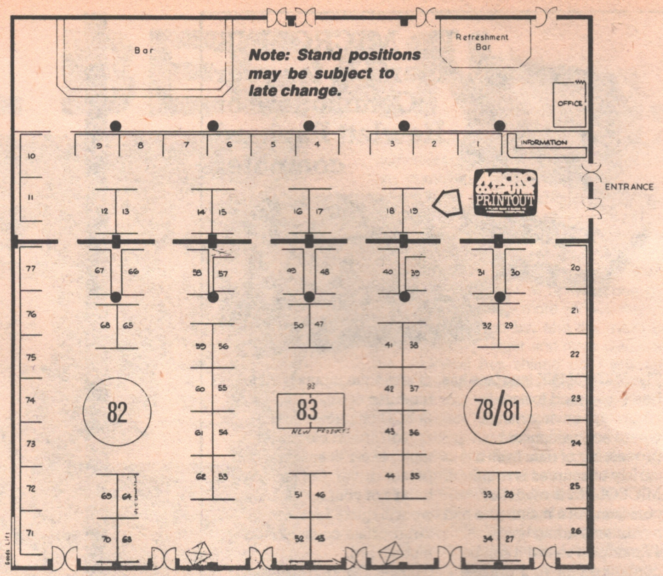
If a printer and disk drive have to be bought for each terminal, this proves very expensive. Using the *Vicswitch* – assuming the product comes up to scratch – it will be possible to share these resources. Moreover, it means that educational programs can be shared.

As Watts points out, this is not networking in the purest sense; if simultaneous random access is required from several sources, the users have to 'queue' until the network is free.

On the other hand, a distance of up to 50 metres is possible between VICs, allowing for considerable flexibility within large buildings.

Watts also believes this will be of interest to factories. For example, monitors on different production lines could be used to update a common database. He thinks offices could use this product also. 'It's basically a low-cost solution,' he says.

'It's multi-access, but not multi-tasking.'



Note: Stand positions may be subject to late change.

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NEW COMMANDS IN SOFTCHIP LIBRARY.

» LINES	52	Calculates the number of lines in a program.
» DREAD	110	Reads data from disk without input restrictions
» SCROLL	233	Scroll screen contents up, down, left or right.
» SORT	760	Sorts any one-dimensional array(& tags another array along)

AUTO	38	Provides automatic line numbering
BEEP	64	Plays music of given duration and pitch
BLOAD	38	Load in a block of memory without affecting BASIC execution.
BSAVE	120	Saves the memory area between two given addresses.
CALL	77	Enter a machine-code subroutine with given Acc,X- & Y-reg.
CIF,CEND ELIF,ELSE	221	Four commands which provide facilities for structured BASIC, largely eliminating the need for the GOTO command.
CURSOR	29	Places the cursor at position x,y on the screen.
DATIN	688	Foolproof input routine for dates with full error detection.
DELETE	65	Deletes a given range of program lines.
DISABLE	45	Disables the run/stop key without affecting the internal clock.
DISP	133	Displays a prompting or warning message on a given line.
DMERGE	309	Merges a program stored on disk into the current program .
DSEARCH	327	Searches a disk relaitve-file for a given string or pattern.
DSHR	347	Compresses a date-number to two bytes for economical storage
DUMP	165	Outputs the names and values of all current scalar variables.
DXPD	474	Expands the two bytes from DSHR back into date-number.
EDIT	65	Adds 'delete-forwards' function.
EXEC	140	Executes a string as a BASIC command.
FIND	202	Lists all lines in which a given character string appears.
GENIN	696	General foolproof input routine with selected key disablement.
GSUB	112	Performs a GOSUB to a given labelled line.
GTO	88	Performs a GOTO as above.
INPUT	39	Allows a program to continue despite a null entry being input
INVERT	157	Turns a string back to front.
IRQ	55	Restores normal system use of interrupts.
KILL	24	Takes out SOFTCHIP commands.
LWIND	165	Loads a screen display from a compressed format file.
MERGE	362	Merges a program stored on tape into the current program.
MON	13	Enters the CBM machine-code monitor.
MOVE	129	Moves a block of memory to another position in RAM
NSHR	340	Compresses a number into four bytes
NUMIN	736	Foolproof input routine for amounts of money.
NXPD	333	Expands the four bytes from NSHR back into a normal value.
PCTRL	105	Set the device number and characteristics of the printer.
PLOT	173	Plots a double-density point on the screen.
POP	31	Removes the last subroutine return address from the stack.
PRINT	126	Adds routine to automatically right-justify amounts of money
PRINT	283	Modifies all printer-output as needed and adds TAB function
PUSH	59	Pushes a return address onto the stack
RENU	929	Renumbers a program, altering all GOTO's, THEN's,etc.
REPEAT	50	Adds repeat key function.
REPLACE	485	Replace all occurences of one character string with another.
RESCUE	37	Recovers a program accidentally 'NEW'ed.
RESET	174	Resets a double-density point on the screen.
RESTORE	18	Restores DATA back to a given line number.
REVERSE	49	Reverses the field of the screen.
SCAN	192	Scans a string for the next occurence of a given character.
SCOPY	337	Copies the screen to the printer.
SEARCH	268	Searches an array for a given string or pattern.
SHRINK	177	Removes all unnecessary spaces and 'REM's from a program
SWAP	393	Loads in another program, retaining all variables.
SWIND	153	Saves the contents of the screen in a compressed format.
TRACE	105	Displays the last six line numbers at the top-right screen
VAR	385	Outputs the names of all variables referred to in a program
WINDOW	34	Sets top,bottom,left,right for an 8032 screen window.
WPOKE	48	Pokes two memory locations in hi-lo 6502 order.

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